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UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 6 No. 18A
Abstracts 5248-5529
Sept. 30, 1952

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ERRATA

NSA, Vol. 6, No. 14, p. vii. In abstract 4004, the senior author should be G. L. Clark.

NSA, Vol. 6, No. 14, p. 494. In abstract 4004, the senior author should be G. L. Clark.

REPORTS REFERENCE LIST

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

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ORNL-1114 5363
Oak Ridge National Lab.
STRESS-STRAIN-TIME PHENOMENA IN MECHANICAL TESTING. A STUDY OF THE STRESS-STRAIN-TIME FUNCTIONS OF METALS IN SIMPLE MONOTONIC TENSION, by A. G. H. Andersen. Issued May 26, 1952. 104p. (ORNL-1114)

ORNL-1278 5398
Oak Ridge National Lab.
PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 50p. (ORNL-1278)

ORNL-1278(p.2-12) 5474
Oak Ridge National Lab.
HIGH-VOLTAGE PHYSICS AND RADIOACTIVITY AND NUCLEAR ISOMERISM GROUPS, p.2-12 of PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 11p. (ORNL-1278(p.2-12))

ORNL-1278(p.12-38) 5399
Oak Ridge National Lab.
NEUTRON DIFFRACTION, HEAVY-ION PHYSICS, THEORETICAL PHYSICS, AND INSTRUMENTATION GROUPS, p.12-38 of PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 27p. (ORNL-1278 (p.12-38))

ORNL-1355 5422
Oak Ridge National Lab.
ELECTROMAGNETICALLY ENRICHED ISOTOPES INVENTORY, JULY 31, 1952, by C. P. Keim, C. E. Normand, and Boyd Weaver. July 31, 1952. 39p. (ORNL-1355)

ORO-75 5251*
[Tennessee Valley Authority]
THE SECOND SPRING ESTIMATE OF THE SIZE OF THE FISH POPULATION OF WHITE OAK LAKE, MARCH–APRIL 1952, by William T. Miller and Louis A. Krumholz. July 29, 1952. 8p. (ORO-75)

SEP-100 5388
Sylvania Electric Products, Inc.
SELF-DIFFUSION OF METALS AND ASSOCIATED PHENOMENA (VII); PROGRESS REPORT FOR OCTOBER 1, 1951 TO APRIL 1, 1952, by R. W. Balluffi, H. P. Kling, F. D. Rosi and L. Seigle. Issued June 23, 1952. 15p. (SEP-100)

SO-2022 5389
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; FOURTEENTH QUARTERLY REPORT, PROGRESS REPORT NO. 31, by J. Hollomon and D. Turnbull. July 5, 1952. 7p. (SO-2022; RL-713; Progress Report No. 31)

UCLA-207 5277
Atomic Energy Project, Univ. of Calif., Los Angeles
INFLUENCE OF PERIPHERAL CHOLINERGIC BLOCKING DRUGS ON SURVIVAL TIME IN ROENTGEN RAY IRRADIATED MICE, by Thomas J. Haley and Bonnie M. Rhodes. Issued July 13, 1952. 8p. (UCLA-207)

UCLA-209 5418
Atomic Energy Project, Univ. of Calif., Los Angeles
A NEW EXTERNAL OBJECTIVE APERTURE CENTERING AND INTERCHANGING DEVICE FOR THE RCA EMU ELECTRON MICROSCOPE, by F. W. Bishop and S. B. Elliott. Issued July 25, 1952. 10p. (UCLA-209)

UCLA-210 5419
Atomic Energy Project, Univ. of Calif., Los Angeles
A DEVICE FOR MONITORING THE STABILITY OF THE POWER SUPPLIES OF THE ELECTRON MICROSCOPE, by F. W. Bishop and S. B. Elliott. Issued July 25, 1952. 8p. (UCLA-210)

UCLA-211 5509
Atomic Energy Project, Univ. of Calif., Los Angeles
BETA AND GAMMA INDUCED CĚRENKOV RADIATION IN WATER, by M. A. Greenfield, A. Norman, A. H. Dowdy, and P. M. Kratz. Issued July 25, 1952. 9p. (UCLA-211)

UCLA-212 5252
Atomic Energy Project, Univ. of Calif., Los Angeles
INITIAL STUDIES OF THE PENETRATION OF BIOLOGICAL TISSUES BY SUPERSONIC LIQUID JETS, by Brian Dunne, Benedict Cassen and Herbert Gass. Issued July 23, 1952. 15p. (UCLA-212)

UCLA-213 5253
Atomic Energy Project, Univ. of Calif., Los Angeles
THE MEASUREMENT OF THORACIC VISCERAL PLASMA VOLUME, by Alvin E. Lewis. Issued Aug. 1, 1952. 15p. (UCLA-213)

UCLA-214 5254
Atomic Energy Project, Univ. of Calif., Los Angeles
THE ESTIMATION OF THE PLASMA VOLUME OF THE HEART, by Alvin E. Lewis. Issued Aug. 6, 1952. 15p. (UCLA-214)

UCRL-1739 5481
Radiation Lab., Univ. of Calif.
RESONANCE MAPS FOR LINEAR ACCELERATORS, by Sumner W. Kitchen and Robert G. Smits. Feb. 27, 1952. 34p. (UCRL-1739)

UCRL-1833 5510
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF WEEKLY RESEARCH PROGRESS MEETING, by S. Shewchuck. May 15, 1952. 6p. (UCRL-1833)

UCRL-1835 5475
Radiation Lab., Univ. of Calif.
METHODS OF CALCULATING YIELDS IN CHAINS OF SUCCESSIVE NUCLEAR TRANSFORMATIONS, by John O. Rasmussen, Jr. and Rosemary J. Barrett. May 26, 1952. 28p. (UCRL-1835)

UCRL-1843 5430
Radiation Lab., Univ. of Calif., Berkeley
A STABLE MICROWAVE REFERENCE SYSTEM, by R. G. Smits and A. J. Schwemin. June 11, 1952. 23p. (UCRL-1843)

UCRL-1853 5420
Radiation Lab., Univ. of Calif., Berkeley
INSTRUCTION MANUAL FOR UCRL PORTABLE VAPOR DETECTOR MODEL 1EPS, by C. S. Presenz. May 10, 1952. 15p. (UCRL-1853)

UCRL-1854 5454
Radiation Lab., Univ. of Calif., Berkeley
PHYSICS DIVISION QUARTERLY REPORT [FOR] FEBRUARY, MARCH, AND APRIL, 1952. June 16, 1952. 46p. (UCRL-1864)

UCRL-1857 5346
Radiation Lab., Univ. of Calif., Berkeley
HIGH ENERGY HELIUM-ION IRRADIATION OF FORMIC

ACID IN AQUEOUS SOLUTION, by Warren M. Garrison, Donald C. Morrison, Herman R. Haymond, and Joseph G. Hamilton. June 13, 1952. 7p. (UCRL-1857)

UCRL-1869 5303
Radiation Lab., Univ. of Calif., Berkeley
THEORETICAL CONSIDERATIONS ON CELL SHAPE, CONVECTION; AND AN AREA ANOMALY PERTINENT TO DEVELOPING A MOVING BOUNDARY THEORY FOR ULTRACENTRIFUGATION, by Rodes Trautman. July 8, 1952. 32p. (UCRL-1869)

UCRL-1881 5457
Radiation Lab., Univ. of Calif., Berkeley
SYMMETRICAL PSEUDOSCALAR MESON THEORY OF NUCLEAR FORCES, by Joseph V. Lepore. July 3, 1952. 8p. (UCRL-1881)

UR-207 5267
Atomic Energy Project, Univ. of Rochester
A FORMULATION OF THE INJURY, LIFE SPAN, DOSE RELATIONS FOR IONIZING RADIATIONS; II. APPLICATION TO THE GUINEA PIG, RAT AND DOG, by H. A. Blair. July 3, 1952. 37p. (UR-207)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE G/M-89 5335
[Atomic Energy Research Establishment, Harwell, Berks (England)]
SIMPLE METHOD OF DRYING HYDROGEN, NITROGEN AND ARGON, by E. R. Harrison. June 12, 1951. 3p. (AERE G/M-89)

AERE G/M-129 5336
Atomic Energy Research Establishment, Harwell, Berks (England)
INTENSE PURIFICATION OF GASES WITH ALKALI METALS, by E. R. Harrison. Apr. 6, 1952. 5p. (AERE G/M-129)

AERE-T/R-871 5426
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ENERGY DEPOSITION BY FAST NEUTRONS IN BONE MARROW, by J. H. Tait. Feb. 1952. 10p. (AERE-T/R-871)

FZA-X6-501 5359
Consolidated Vultee Aircraft Corp.
NOTES ON THE FLUID DYNAMIC AND HEAT TRANSFER ASPECTS OF REACTOR DESIGN, by W. A. Spraker. Sept. 24, 1951. 20p. (FZA-X6-501; ATI-154974)

NACA-TN-2745 5381
Michigan Univ.
INFLUENCE OF CHEMICAL COMPOSITION ON RUPTURE TEST PROPERTIES AT 1500°F OF FORGED CHROMIUM-COBALT-NICKEL-IRON BASE ALLOYS, by J. W. Freeman, J. F. Ewing, and A. E. White. July 1952. 69p. (NACA-TN-2745)

NACA-TN-2746 5382
Carnegie Inst. of Tech.
PREVIEW OF BEHAVIOR OF GRAIN BOUNDARIES IN CREEP OF ALUMINUM BICRYSTALS, by F. N. Rhines and A. W. Cochardt. July 1952. 40p. (NACA-TN-2746)

NACA-TN-2750 5360
Lewis Flight Propulsion Lab., NACA
MATRIX AND RELAXATION SOLUTIONS THAT DETERMINE SUBSONIC THROUGH FLOW IN AN AXIAL-FLOW GAS TURBINE, by Chung-Hua Wu. July 1952. 65p. (NACA-TN-2750)

NBS-1631 5325
National Bureau of Standards
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1947, by Lawrence M. Brown and Charles W. Beckett. June 1, 1952. 61p. (NBS-1631)

NBS-1685 5326
National Bureau of Standards
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1948, by Lawrence M. Brown and Charles W. Beckett. July 21, 1952. 78p. (NBS-1685)

NP-3880 5350
Harvard Univ.
PHOTOMETRIC STUDIES OF DERIVATIVES OF TRIPHENYLMETHANE IN LIQUID SULFUR DIOXIDE; TECHNICAL REPORT NO. 6 COVERING PERIOD 1 APRIL 1951–1 SEPTEMBER 1951, by Paul D. Bartlett and Ralph E. Weston, Jr. Apr. 10, 1952. 33p. (NP-3880; Technical Report No. 6; U22300)

NP-3888 5383
Armour Research Foundation
BRAZING AND SOLDERING OF TITANIUM AND ITS ALLOYS; INTERIM TECHNICAL REPORT NO. 1, SEPTEMBER 1, 1951–JANUARY 31, 1952, by N. A. DeCecco, Robert R. Banks and John M. Parks. [nd] 27p. (NP-3888; Interim Technical Report No. 1; U22418)

NP-3915 5322
Connecticut Univ.
TERNARY COMPOUNDS; FIRST TECHNICAL REPORT FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1952, by Roland Ward, Aaron Wold, Beatrice Gushee, and Dana H. Ridgley. [nd] 46p. (NP-3915; U22515)

NP-3929 5384
Armour Research Foundation
DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 1, OCTOBER 1, 1951 - JANUARY 31, 1952, by W. Rostoker. [nd] 32p. (NP-3929; U22548; Interim Technical Report No. 1)

NP-3933 5349
William H. Chandler Lab., Lehigh Univ.
HETEROGENEITY OF SURFACES, ADSORPTION OF GASES ON METALS; MOLYBDENUM AND THE THERMODYNAMICS OF ADSORPTION; OFFICE OF NAVAL RESEARCH TECHNICAL REPORT NUMBER 4; 1 JUNE 1951 TO 31 MAY 1952. [nd] 77p. (NP-3933; U22550)

NP-3942 5361
Massachusetts Inst. of Tech.
METEOR; THE MECHANICS AND THERMODYNAMICS OF STEADY ONE-DIMENSIONAL GAS FLOW WITH TABLES FOR NUMERICAL SOLUTIONS, by A. H. Shapiro, W. R. Hawthorne, and G. M. Edelman. Dec. 1, 1947. 81p. (NP-3942)

NP-3951 5351
[Mallinckrodt Chemical Lab., Harvard Univ.]
THE PURE QUADRUPOLE SPECTRA OF SOLID CHLOROACETIC ACIDS AND SUBSTITUTED CHLOROACETIC ACIDS, by Harry C. Allen, Jr. [nd] 10p. (NP-3951; U22745)

NP-3961 5301
Texas Univ.
TECHNICAL REPORT TO THE OFFICE OF NAVAL RESEARCH ON THE ELECTROCHEMICAL POLARIZATION OF TITANIUM IN NaCl SOLUTIONS, by Norman Hackerman and Colby D. Hall, Jr. June 1, 1952. 55p. (NP-3961; U22757)

NP-3978 5327
Washington Univ.
THE PHYSICAL PROPERTIES OF SOME FLUORINATED PENTANES; TECHNICAL REPORT (thesis), by Leland L. Burger. [nd] 71p. (NP-3978; U-16337)

NP-3979 5328
Washington Univ.
THE LIQUID-VAPOR EQUILIBRIUM OF THE SYSTEM TUNGSTEN HEXAFLUORIDE–PERFLUORO-n-PENTANE, AND SOME RELATED STUDIES; TECHNICAL REPORT (thesis), by Eugene John Barber. Dec. 1948. 119p. (NP-3979; U-2625)

NP-3986 5248
Atomic Energy Research Establishment, Harwell, Berks (England)
HARWELL, THE BRITISH ATOMIC ENERGY RESEARCH ESTABLISHMENT, 1946-1951. 1952. 128p. (NP-3986)

NP-3991 5385
Watertown Arsenal
METALLURGICAL ADVISORY COMMITTEE ON TITANIUM; SUMMARY OF ROUND TABLE MEETING ON SURFACE TREATMENT OF TITANIUM HELD AT WATERTOWN ARSENAL [ON] MAY 20, 1952. May 20, 1952. 18p. (NP-3991)

PR-P-14-E 5417
Chalk River Project (Canada)
PROGRESS REPORT [FOR] FEBRUARY–MAY, 1952; ELECTRONICS BRANCH, by J. Hardwick. [nd] 16p. (PR-P-14-E)

RAE TN-MET-15b 5387
Royal Aircraft Establishment, Farnborough, Hants (England)
REVIEW OF THE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS, by J. T. Ballett. Jan. 1952. 72p. (RAE TN-MET-155)

USNRDL-343 5403
Naval Radiological Defense Lab.
REPRESENTATIVE SAMPLING OF DUST PARTICLES IN HIGH VELOCITY AIR STREAMS, by T. C. Goodale, B. M. Carder, and E. C. Evans, III. Issued May 1, 1952. 11p. (USNRDL-343; U22518)

USNRDL-344 5431
Naval Radiological Defense Lab.
MARK V MODEL I BETA-CONTAMINATION MONITOR, by W. F. Joseph, R. M. Bond, and H. C. Rocklitz. Feb. 20, 1952. 18p. (USNRDL-344)

USNRDL-352 5278
Naval Radiological Defense Lab.
STUDIES ON THE TREATMENT OF INTERNAL RADIOACTIVE CONTAMINATION. I. REMOVAL OF A BONE-DEPOSITED FISSION PRODUCT BY THE SALTS OF ETHYLENE DIAMINE TETRA-ACETIC ACID, by S. H. Cohn, J. K. Gong, and M. C. Fishler. June 4, 1952. 16p. (USNRDL-352)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 September 30, 1952 No. 18A

GENERAL

RESEARCH PROGRAMS

5248
Atomic Energy Research Establishment, Harwell, Berks (England)
HARWELL, THE BRITISH ATOMIC ENERGY RESEARCH ESTABLISHMENT, 1946-1951. 1952. 128p. (NP-3986)

The history of the origin and organization of the British Atomic Energy Research Establishment at Harwell and a summary of the program of work introduces a detailed account of the production program, the isotope program, the reactor program, and the accelerator program. Thirty-two photographs show external and internal views of the establishment. Health protection, fundamental research work, and extramural research and development contracts and information exchange are discussed. An appendix contains descriptions of the GLEEP and BEPO reactors.

BIOLOGY AND MEDICINE

5249
Pennsylvania Univ. School of Medicine
THE NUCLEAR CYTOLOGY OF EREMASCUS ALBUS, by Edward D. DeLamater, Sidney Yaverbaum and Lucille Schwartz. [nd] 20p. (AECU-2152)

A study of the nuclear cytology of the yeast Eremascus albus provided evidence that in this group of organisms the sexual fusion to two nuclei is followed by a process of meiosis and post-meiotic mitosis which normally results in the formation of eight ascospores. The number of haploid chromosomes for this group of organisms was determined to be six.

5250
Sloan-Kettering Inst. for Cancer Research
NUCLEI FROM NORMAL AND LEUKEMIC MOUSE SPLEEN. III. THE DESOXYPENTOSE NUCLEIC ACID CONTENT PER NUCLEUS CALCULATED FROM TOTAL CELL COUNTS, by Nancy A. Mizen and Mary L. Petermann. [nd] 12p. (AECU-2163)

A procedure for making total cell counts on mouse spleen is described. The desoxypentose nucleic acid (DNA) contents per nucleus calculated from the DNA contents and cell counts on the whole tissues were determined to be 6.6×10^{-9} mg for normal spleen; 7.3 for spontaneous leukemia, and 7.4 for transplanted leukemia. The number of cells per gram of spleen was determined to be 22.9×10^8 for normal spleen; 17.5×10^8 for spontaneous leukemia; and 15.7×10^8 and 14.1×10^8 for transplanted leukemias. The same values were obtained for the DNA content per nucleus either by analysis and cell counts of whole spleen or by analysis and counts of isolated nuclei. This suggests that when nuclei are isolated in a neutral sucrose-$CaCl_2$ medium no DNA is lost during the isolation procedure and that the isolated nuclei are representative of the total population.

5251
[Tennessee Valley Authority]
THE SECOND SPRING ESTIMATE OF THE SIZE OF THE FISH POPULATION OF WHITE OAK LAKE, MARCH–APRIL 1952, by William T. Miller and Louis A. Krumholz. July 29, 1952. 8p. (ORO-75)

5252
Atomic Energy Project, Univ. of Calif., Los Angeles
INITIAL STUDIES OF THE PENETRATION OF BIOLOGICAL TISSUES BY SUPERSONIC LIQUID JETS, by Brian Dunne, Benedict Cassen and Herbert Gass. Issued July 23, 1952. 15p. (UCLA-212)

Supersonic liquid jets were produced with a "Hypospray" injector. The jets were photographed with two spark-shadowgraph units having exposure times of approximately 5×10^{-7} sec. Intervals between the exposures were varied from 5 to 40 μsec. Some of the shadowgraphs show complex phenomena occurring, such as the somewhat periodic occurrence of nodules on the jet which seem to propagate and break analogously to wind-produced waves. The nodules have ballistic-like head and tail air shock waves associated with them. Jets of mercury being much slower, break up in droplets in general accord with the Rayleigh theory of surface-tension waves. (auth)

5253
Atomic Energy Project, Univ. of Calif., Los Angeles
THE MEASUREMENT OF THORACIC VISCERAL PLASMA VOLUME, by Alvin E. Lewis. Issued Aug. 1, 1952. 15p. (UCLA-213)

The dye-dilution curve obtained in the measurement of cardiac output by the rapid injection method may be expressed as $P = Q_i f(t)$, where P is the plasma concentration of dye; Q_i is the quantity injected, and t is time. If the single injection is considered as a constant infusion at rate R terminated at the end of a brief time interval, Δt, the time-course of plasma concentration, P_t, during a comparable uninterrupted constant infusion can be obtained as $P_t = R\Delta t\,[f(t) + f(t-\Delta t) \ldots . f(t-n\Delta t)]$, where the time of interest is n intervals from the onset of the curve. The plasma volume of the thoracic viscera, V, may then be calculated as:

$$V = \Delta t\, C\left[n - \frac{C}{Q_i} \int_0^{n\Delta t} P_t\, dt\right]$$

where C is the cardiac output. In a series of 10 rabbits the mean proportion of the total plasma volume in the thoracic viscera was observed to be 42.2% with a standard deviation of 3.1% (18.8% of mean). This proportion is approximately 10 times as great as that previously measured by direct extraction in anesthetized rats with collapsed lungs. (auth)

5254
Atomic Energy Project, Univ. of Calif., Los Angeles
THE ESTIMATION OF THE PLASMA VOLUME OF THE HEART, by Alvin E. Lewis. Issued Aug. 6, 1952. 15p. (UCLA-214)

In estimating the plasma volume of the heart it is assumed that the right and left ventricles and the pulmonary vascular bed act as three simple diluting pools arranged in series. A mathematical expression may then be analytically derived for the dye-dilution curve obtained during the measurement of cardiac output. With this equation the volumes of the three pools may be calculated. This hypothesis is justified on the basis of three experimentally observed

consistencies: (1) The theoretically calculated curves closely approximate the experimental curves. (2) The relations between the coefficients and exponents obtained empirically are those predicted by the theoretical analysis. (3) The sum of the three volumes is approximately equal to an independent determination of the total volume of the thoracic viscera. (auth)

5255
A MULTICURIE IRRADIATION SITE FOR EXPOSURE OF LARGE ANIMALS TO WHOLE-BODY GAMMA IRRADIATION. James L. Wilding, Charles S. Simons, and John H. Rust. Nucleonics 10, No. 5, 36-40(1952) May.

Reasonably uniform whole-body γ irradiation of untethered large animals at about 40 r/hr is possible in the outdoor exposure field described. The time-intensity relationship is flexible, and either laboratory or domestic animals can be used. A procedure is described for loading and unloading the field with radioactive charges with a minimum radiation hazard to personnel. An actual experiment performed in the field is described to illustrate its usefulness.

5256
VARIATIONS IN THE RELATIVE ABUNDANCE OF THE CARBON ISOTOPES IN PLANTS. Frans E. Wickman. Geochim. et Cosmochim. Acta 2, 243-54(1952). (In English)

The C^{12}/C^{13} ratio of 105 plants representing all the major systematic groups has been determined. Except perhaps for gymnosperms there are in principle no systematic differences between the groups. Characteristic differences occur, however, between plants grown in different biotopes, and these differences are related to the varying intensity of the local CO_2 cycle. (auth)

RADIATION EFFECTS

5257
Chicago Univ.
THE LOCALIZATION OF X-RAY INJURY TO THE INITIAL PHASES OF ANTIBODY RESPONSE, by William H. Taliaferro, Lucy Graves Taliaferro and Eugene F. Janssen. [nd] 44p. (AECU-2147)

An abstract of this report was indexed as report AECU-1846 and appears in Nuclear Science Abstracts as NSA 6-1395.

5258
Philadelphia General Hospital
INFRARED SPECTROSCOPY OF LIVER TISSUE IN ADULT AND FETAL RATS, by H. P. Schwarz, H. E. Riggs, C. Glick, J. McGrath, W. Cameron, E. Bew, Jr., and R. Childs. [nd] 10p. (AECU-2150)

The characteristic infrared absorption bands of liver tissue of rats are described, and comparisons are made between the bands of adult and fetal liver tissues. Preliminary studies indicated that ionizing radiation did not significantly change the location of the absorption bands in adult or fetal liver tissues. The role of glycogen in producing characteristic bands of the liver spectrum is discussed.

5259
Kansas Univ.
A SEMI-QUANTITATIVE STUDY OF THE EFFECTS OF RADIOPHOSPHORUS ON THE SPLEEN OF THE COTTON RAT, SIGMODON HISPIDUS TEXIANUS, by Donald S. Overend, A. Byron Leonard and Charles A. Leone. [nd] 44p. (AECU-2156)

Following the intraperitoneal injection of 50 μc of P^{32}, the spleens of rats were examined microscopically at time intervals of 1 to 63 days, and quantitative counts of the cellular constituents were made. Changes in splenic tissue observed included thinning of the stroma and nuclear disorganization in occasional cells, shifts in the relative quantities of the various splenic cellular constituents, notably the reduction in number of some of the more radiosensitive cellular elements, and the compensatory increase in number of other cell types. These derangements of cellular balance were found to be transient, with the normal range of values restored in 63 days or less.

5260
Kansas Univ.
THE EFFECT OF A LARGE SINGLE DOSE OF PHOSPHORUS^{32} ON THE BONE MARROW OF THE COTTON RAT, SIGMODON HISPIDUS TEXIANUS, by Georgine Phillips, A. Byron Leonard and Charles A. Leone. [nd] 29p. (AECU-2157)

A single 4.3-μc/g-intraperitoneal injection of P^{32} produced a trend toward low percentage value of the cells of the white-cell series in the sternal marrow of the mature cotton rat. Distinct aplasia was noted in the white-cell foci at about 7 days, when the cells disappeared rapidly. Between 7 and 9 days recovery began, and by the end of 57 days the normal quantity of cells was found. The red-cell foci were relatively undisturbed. A moderate initial destruction of the hematopoietic tissue was observed to occur between 1 and 12 hr following P^{32} administration. Between 7 and 9 days the trend toward regeneration of the bone marrow was observed to begin, with significant regeneration apparent at 57 days.

5261
Brookhaven National Lab.
THE EFFECT OF COBALT^{60} GAMMA RADIATION ON SUSCEPTIBILITY AND IMMUNITY TO TRICHINOSIS, by Richard D. Stoner and William M. Hale. [nd] 11p. (BNL-1193)

Whole-body Co^{60} γ irradiation of 550 to 650 rep increased the susceptibility of Swiss mice to infections with Trichinella spiralis. Exposure of Trichinella-immune mice to 600 rep before administering a challenge infection destroyed their immunity to reinfection. Data are presented on the effects of 680 rep radiation on the total leukocyte count in the peripheral blood of mice. The sharp reduction in the number of circulating leukocytes may indicate that the role of cellular immunity should be emphasized more in acquired immunity to infections with Trichinella spiralis. (auth)

5262
Brookhaven National Lab.
A COMPARISON OF THE EFFECTS OF X-RAYS AND THERMAL NEUTRONS ON DORMANT SEEDS OF BARLEY, by Richard S. Caldecott, E. F. Frolik and Rosalind Morris. [nd] Brookhaven National Lab. and Univ. of Nebraska. 13p. (BNL-1195)

Dormant seeds of Himalaya barley were subjected to various doses of either x rays or thermal neutrons. Seedlings from seeds treated with x rays had a wide range in height distributions at 14 days, whereas those from thermal neutron irradiation had a narrow range. Differential killing was a characteristic of the material subjected to the three highest doses of x radiation. Such a lethality pattern did not occur in the thermal-neutron-treated material, i.e., if any seedlings survived a treatment, essentially all of them did. For similar chromosomal aberration frequencies there was less seedling injury in seeds subjected to thermal neutrons than in seeds treated with x rays. Apparently x rays have proportionately more effect on the extra-chromosomal elements of the cell than do thermal neutrons. (auth)

5263
Brookhaven National Lab.
STERILITY AND RECESSIVE LETHAL MUTATION FOLLOWING X-IRRADIATION OF FEMALE DROSOPHILA MELANOGASTER, by R. C. King. [nd] 14p. (BNL-1198)

Sex-linked recessive lethals were recovered from successive batches of eggs laid by female Drosophila melanogaster irradiated with 4,000 r of x rays. While the initial frequency

of lethals is identical to that of males treated in a similar manner, there is an immediate linear decline in lethal frequency which reaches a value only 60% of the initial frequency in eggs laid 7 to 12 days after irradiation. The decline in frequency is taken to represent the elimination in immature germ cells of induced lethal effects belonging to the class of chromosome aberrations. The fecundity and/or fertility of irradiated females is greatly reduced for the first four days after treatment. A rise in female productivity occurs between days 4 and 5. After a week has passed the productivity of treated females is almost normal, although the eggs produced by the females contain 60% of the sex-linked lethal frequency of eggs produced immediately after irradiation. The rise in productivity of females from 4 to 5 days after treatment is explained by assuming that the eggs laid at this time were 16-cell cysts at the time of irradiation and were resistant to irradiation in much the same fashion as is polyploid tissue. (auth)

5264
Brookhaven National Lab.
EVERYDAY RADIATION, by Frederick P. Cowan. [nd] 24p. (BNL-1208)

A survey of sources of natural background radiation is presented which discusses some common examples of artificial radiation and briefly summarizes the effects of radiation on human beings.

5265
Western Reserve Univ. School of Medicine
NITROGEN BALANCE IN WHOLE BODY X-RADIATION, by Gordon E. Gustafson and Simon Koletsky. Issued June 15, 1952. 13p. (NYO-1649)

In an effort to determine whether the decrease in weight following irradiation is due to starvation or to an alteration in metabolism, a comparison was made of the N balance of rats given whole-body x radiation with that of nonirradiated controls receiving the same quantity of food. For the first 6 days following 660 r of whole-body x irradiation rats were in marked negative N balance. A second period of negative N balance occurred in irradiated rats during the second or third week post-irradiation. Water intake in the 660-r x-irradiated rats decreased markedly on the second and third day post-irradiation, whereas the intake of the control rats increased markedly. Urinary output in both groups followed the same trend as the water intake. For the first 3 days following whole-body x irradiation, rats which received 660 r showed a greater N excretion and a more negative N balance than did animals which received 1000 r. Possible causes for these changes in N balance are discussed.

5266
Western Reserve Univ. School of Medicine
LIVER DAMAGE IN RATS FROM RADIOACTIVE COLLOIDAL GOLD, by Simon Koletsky, Gordon Gustafson, Phyllis Goldston, Eileen Goodman, and Vera Milanich. Issued June 15, 1952. 17p. (NYO-1650)

Internal radiation of the rat liver by means of a single massive dose of radioactive colloidal gold resulted in profound hepatic cell necrosis, distortion of architecture, and conversion of most of the surviving parenchyma to atypical giant cells. The lesion resembled cirrhosis but was not accompanied by substantial fibrosis. Kupffer cells, biliary epithelium, and blood vessels were not significantly injured. Jaundice and ascites were frequent and there was evidence of hepatic dysfunction. (auth)

5267
Atomic Energy Project, Univ. of Rochester
A FORMULATION OF THE INJURY, LIFE SPAN, DOSE RELATIONS FOR IONIZING RADIATIONS; II. APPLICATION TO THE GUINEA PIG, RAT AND DOG, by H. A. Blair. July 3, 1952. 37p. (UR-207)

The hypothesis that radiation injury develops in proportion to the dose rate and subsides at a rate proportional to its own magnitude, except for an irreparable component proportional to the total dose, is shown to represent adequately data on the chronic irradiation of the rat with x rays and the guinea pig with γ rays. A few data on x irradiation of the dog and fast-neutron irradiation of the rat also are discussed. The hypothesis is tested by solutions of the differential equation $dI/dt = A\gamma - \beta(I - \alpha\gamma t)$, in which I is injury, γ the dose rate and A, β, and α are constants. Agreement with the data is found when I is equated to S_0-S, S_0 and S being the median or mean survival times of the control and experimental animals, respectively. The constants A and α are about proportional to the survival times of the various species. Consequently, extrapolation to unmeasured mammalian species may be made in fair approximation. The constant β is not proportional to survival times of the various species, but it may decrease to a constant value in the larger species. Comparisons are made between irradiation effects in the mouse and dog in anticipation that they typify the smaller and larger mammals. (auth)

5268
CLINICAL OBSERVATIONS UPON THE RESPONSE OF THE BURRO TO LARGE DOSES OF EXTERNAL WHOLE BODY GAMMA IRRADIATION. Bernard F. Trum, John H. Rust, and James L. Wilding. Auburn Vet., 131-6(1952) Spring.

One hundred and twenty-three burros were exposed to whole-body γ radiation in dosages ranging from nonfatal to 100% fatal. General symptoms included apathy and malaise, dullness, restlessness, and anorexia. Specific points checked were locomotion, pulse, respiration, temperature, eyes, gastro-intestinal tract, genito-urinary system, blood, and neuro-motor symptoms. The most spectacular occurrence of death was sudden collapse of apparently well burros. From the 14th day onward animals died with increasingly severe symptoms.

5269
BIOLOGIC ASSAY OF THE EXIT DOSE IN DERMATOLOGIC ROENTGEN THERAPY. Hans M. Buley and Myron H. Kulwin. J. Investigative Dermatol. 18, 397-402(1952) May.

A technique has been demonstrated for biologically assaying surface absorption of x radiation, utilizing the depigmenting effect of x rays on mouse hair. By applying this technique to irradiation of areas on the mouse trunk, and subsequently observing the hair changes on the exit surface, it has been shown that the physically measured exit dose is roughly equivalent to the biologically effective exit dose through 1.5 cm of tissue at 50 to 100 kv. (auth)

5270
COMPARISON OF AIR AND TISSUE DOSES FOR RADIUM GAMMA RAYS. Michel Ter-Pogossian, William B. Ittner, III, and Samira M. Aly. Nucleonics 10, No. 6, 50-2(1952) June.

The equivalence between air and tissue doses has been investigated by means of water phantoms and a scintillation counter. The air-to-tissue-dose ratio is greater than unity, and independent of phantom size in the volume range from $(10\ cm)^3$ to $(60\ cm)^3$.

5271
PREVENTION OF SIDE EFFECTS IN STERILIZATION OF FOODS AND DRUGS BY IONIZING RADIATIONS. B. E. Proctor and S. A. Goldblith. Nucleonics 10, No. 4, 64-5 (1952) Apr.

The reactions of high-energy radiation in water are shown. When a food is bombarded by ionizing radiation, an off-flavor occurs when the flavor molecule takes on an OH radical and gives an oxidized off-flavor. If some free-radical-accepting compound is added, it competes with the flavor molecule for the OH radical. Ascorbic acid, d-iso-ascorbic

acid, and their salts eliminate off-flavor in the case of several foods. Another side effect is the hemolysis of red blood cells exposed to radiation. Na ascorbate inhibits the hemolyzing effect of the radiation.

5272

EFFECT OF ROENTGEN IRRADIATION UPON GROWTH AND PERIPHERAL BLOOD CELL LEVELS OF THE ALBINO RAT. Thomas R. Noonan and Ann M. Noonan. Federation Proc. 11, (1952) Mar.

Three-week-old albino rats, both male and female, were exposed daily or weekly to whole-body roentgen irradiation. The effect of these procedures on growth (as measured by body weight) and on the levels of hemoglobin, neutrophils, and lymphocytes in the peripheral blood was studied. Exposure to 100 r/week, either as a single dose or in 5 equal daily doses, for 4 weeks resulted in a significant decrease in growth and in absolute lymphocyte counts in both males and females. This procedure did not result in any significant change in hemoglobin levels or in absolute neutrophil counts in a period of 10 weeks of exposure. Exposure to 10 r/day 5 times weekly produced a significant decrease of growth of male but not of female rats during the 10-week period. The changes in peripheral blood-cell levels of normal albino rats between the 3rd and 13th week of life include an increase in hemoglobin concentration, an increase in absolute lymphocyte counts, and little change in absolute neutrophil counts. (Entire report)

5273

EFFECT OF AUREOMYCIN AND WHOLE BLOOD SEPARATELY AND IN COMBINATION ON X-IRRADIATED DOG. F. W. Furth, M. P. Coulter, R. W. Miller, J. W. Howland, and S. N. Swisher. Federation Proc. 11, (1952) Mar.

In order to evaluate the therapeutic effects of aureomycin and whole-blood transfusion, separately and in combination on the acute radiation syndrome, a total of 96 dogs was exposed to 575 r of whole-body x irradiation. The dogs were separated into four equal and comparable groups. One group served as controls and received no therapy. Of the three remaining groups, one received aureomycin orally (approximately 50 mg/kg/24 hr) in two divided doses at 12-hr intervals starting 24 hr after exposure to the irradiation. One group was given whole blood transfusions in 125-cc amounts whenever the individual dog's hematocrit fell below 80% of its preradiation value. The 4th group received both forms of therapy. No statistically significant difference in rate of mortality or 28-day mortality among the four groups was observed. A total of 140 transfusions was administered to 40 dogs for an average of 3.5 transfusions/dog (approximately 50% of the estimated total blood volume). The peak demand for transfusion was on the 14th and 15th days post-radiation. In the blood-treated groups the average hematocrit was maintained at 80% of preradiation value by means of the transfusions. The pathological data suggest that a higher incidence of pulmonary hemorrhage and edema occurred in the blood-treated dogs, indicating a potential hazard in the administration of whole blood during certain stages of the acute radiation syndrome. (Entire report)

5274

INDIRECT EFFECTS OF X-RADIATION ON THE WALL OF THE DEVELOPING MESENCEPHALON OF THE CHICK EMBRYO. M. J. Tobin and J. P. O'Brien. Wasmann J. Biol. 10, 1-6(1952) Spring.

Significant indirect effects of roentgen radiation on the tissue of the wall of the developing chick mesencephalon are described. Compared with direct effects, the indirect effects are more delayed and less severe. That more importance must be attached to indirect effects in studies involving the interaction of ionizing radiations and protoplasmic systems is discussed. (auth)

5275

A COMPARISON OF THE EFFECT OF LOW (124 KV) AND OF HIGH (50 MEV) X IRRADIATION ON THE INCIDENCE OF LENS OPACITIES IN MICE. Leonard B. Clark and Peter Sykowski. Am. J. Ophthalmol. 35, 848-50(1952) June.

Low- and high-voltage x irradiation increases the incidence of lens opacities. The difference in the incidence with both voltages is not significant. The neutron dosage in the 50-Mev betatron appears to be negligible in comparison with the x-ray dosage. (auth)

5276

ORGANIC AND INORGANIC IODINE LEVELS IN SERUM OF SHEEP RECEIVING DAILY ORAL DOSES OF I^{131}. M. H. Weeks, J. Katz, and N. G. Farnham. Endocrinology 50, 511-20(1952) May.

Nine Suffolk ram lambs received daily oral doses of 480 μc of I^{131} over periods of time ranging from 31 to 90 days. Radiation damage to the synthetic function of the thyroid was investigated by measuring the total protein-bound I, the protein-bound I^{131}, and the inorganic I^{131} in the serum of these animals. The I uptake was investigated by external monitoring. The total protein-bound I levels and the conversion ratios, protein-bound I^{131}/total I^{131} in serum, which express the ability of thyroid tissue to convert inorganic I^{131} to the organic form, decreased as a result of thyroid damage due to radiation. Interference with the synthetic function of the thyroid, as evidenced by a fall in conversion ratio, preceded by several days the inhibition of I uptake of the gland as measured by external thyroid monitoring. The determination of conversion ratios may prove to be a convenient procedure for detecting early radiation damage to the thyroid. (auth)

RADIATION HAZARDS AND PROTECTION

5277

Atomic Energy Project, Univ. of Calif., Los Angeles
INFLUENCE OF PERIPHERAL CHOLINERGIC BLOCKING DRUGS ON SURVIVAL TIME IN ROENTGEN RAY IRRADIATED MICE, by Thomas J. Haley and Bonnie M. Rhodes. Issued July 13, 1952. 8p. (UCLA-207)

Mice subjected to 550 r of acute whole-body x-ray irradiation were treated with four cholinergic blocking drugs. None of the antispasmodics tested significantly decreased total mortality.

5278

Naval Radiological Defense Lab.
STUDIES ON THE TREATMENT OF INTERNAL RADIOACTIVE CONTAMINATION. I. REMOVAL OF A BONE-DEPOSITED FISSION PRODUCT BY THE SALTS OF ETHYLENE DIAMINE TETRA-ACETIC ACID, by S. H. Cohn, J. K. Gong, and M. C. Fishler. June 4, 1952. 16p. (USNRDL-352)

By the administration of Na EDTA (ethylenediaminetetraacetic acid) followed by Ca EDTA, it has been shown that it is possible to effect removal of substantial amounts of the fission product Y^{91}, which was fixed by the rat skeleton. Doubling the daily frequency of administration of this treatment resulted in no significant increase in the removal of the isotope from bone. (auth)

5279

HAZARDS ANTICIPATED FROM FISSION PRODUCT USE. P. J. Valaer. Occupational Health 12, 105(1952) July.

Proposed industrial uses of fission products are summarized. The properties of Sr^{90} and Cs^{137} are reviewed. The potential use of fission products in industry is evaluated in terms of occupational and public health hazards presented by the preparation, transportation, use and ultimate disposal of fission products by industry.

5280
THE ROLE OF ENZYMATIC OXYGEN REMOVAL IN CHEMICAL PROTECTION AGAINST X-RAY INACTIVATION OF BACTERIA. G. E. Stapleton, Daniel Billen, and Alexander Hollaender. J. Bact. 63, 805-11(1952) June.

Compounds found to be protective against the lethal action of x rays on bacterial cells can be divided into two classes on the basis of whether or not preincubation with the cells was required for protection. A decrease in protective capacity was correlated with a decrease in respiration rate on those compounds which require preincubation for protection. Cells posessing an active hydrogenase system, exposed to x rays in a H_2-O_2 mixture, were found to be more radioresistant than similar cells exposed in a N_2-O_2 mixture. Production of a highly reductive state in the cells and suspensions did not alter their radioresistance. The data presented are consistent with the hypothesis that O_2 removal rather than H_2 donation is the major mode of protection afforded by chemical protective agents. (auth)

5281
PRACTICE OF RADIOLOGICAL SAFETY. Pt. VI of THE RADIOISOTOPE. AEC Isotopes Div. G. W. Morgan, tech. adviser. 1952. 16 mm film (PMF 5145f). B & W, sound, running time: 33 min. (cf. NSA 6-2840)

The film opens with a discussion between an investigator who has been using radioisotopes for some time and another who is interested in starting a radioisotope program. The discussion and the subsequent visit through the investigator's laboratory cover the topics of handling radioisotope shipments, how therapeutic doses are prepared, the need and function of a local radioisotope committee, laboratory design, decontamination, use of shielding, measurement of personnel exposure, and other matters pertinent to health safety.

RADIOGRAPHY

5282
Cancer Research Inst., New England Deaconess Hospital, Boston
APPLICATION OF THE FREEZE-DRYING TECHNIQUE TO AUTORADIOGRAPHY, by Margaret W. Holt and Shields Warren. [nd] 28p. (AECU-2151)

Possible changes produced by the embedding procedure in preparing tissues for autoradiographic studies of isotope distribution were investigated. Small pieces of tissue from animals which had previously been administered Fe^{59}, P^{32}, or S^{35} were prepared by the freeze-drying and dry-cutting procedures. Preliminary results of comparative studies of tissues embedded in paraffin and in carbowax are reported. Comparative autoradiographic results are discussed for several tissues and for the three different isotopes, and photographs of the autoradiograms discussed are included.

5283
Illinois Univ. Coll. of Medicine
RADIO-MICROGRAPHY AS A TOOL IN BIOLOGICAL INVESTIGATION, by J. E. C. Askin, L. L. Yates, E. W. Cauldwell and R. A. Harvey. [nd] 7p. (AECU-2159)

The technique of radiomicrography is discussed, and the necessary equipment is described. Applications of the technique in the biological sciences are mentioned, and comparison is made with other methods of analysis.

RADIOTHERAPY

5284
Connecticut Agricultural Experiment Station
CROWN GALL SUPPRESSION BY IONIZING RADIATION, by Paul E. Waggoner and A. E. Dimond. [nd] 18p. (AECU-2145)

The effects of ionizing radiation on the development of crown galls caused by Agrobacterium tumefaciens in tomato and kalanchoe was studied. Suppression of galls occurred whether the plants were inoculated with the bacteria before or after irradiation. Pathogenic bacteria both in vitro and in vivo survived doses that caused gall suppression. It was concluded that radiation effects suppression of galls by affecting the host and not the pathogen directly and that the mechanism of suppression affects the growth of host tissues in general. The possible role of the suppression of auxin production by radiation in gall formation is discussed.

5285
Connecticut Agricultural Experiment Station
EXAMINATION OF THE POSSIBILITY OF THERAPY OF PLANT DISEASE WITH IONIZING RADIATION, by Paul E. Waggoner and A. E. Dimond. [nd] 13p. (AECU-2148)

Using a Co^{60} γ-ray source, the sensitivity to external ionizing radiation was determined for the wilt-producing fungi Fusarium oxysporum and for both healthy and wilt-infected tomato plants. Fusarium was found to be considerably more resistant to ionizing radiation than the host, and it was concluded that therapy of Fusarium wilt could not be effected by ionizing radiation from an external source. The distribution of P^{32} was measured in healthy and diseased tomato plants, and no differential uptake was demonstrated in diseased plants, leading to the conclusion that therapy of Fusarium wilt by internal sources of radiation is unlikely.

5286
Cancer Research Inst., New England Deaconess Hospital, Boston
THE INTRACAVITARY ADMINISTRATION OF RADIOACTIVE COLLOIDAL GOLD, by Raymond G. Rose, Melvin P. Osborne, and William B. Stevens. Cancer Research Inst., New England Deaconess Hospital, Boston, and Harvard Medical School and Laboratory of Pathology, Harvard Cancer Commission. [nd] 22p. (AECU-2153)

The properties and clinical applications of radioactive colloidal Au^{198} are reviewed briefly, with special reference to the management of selected cases with recurrent pleural effusion or ascites due to malignant neoplasms. A technique considered to be safe and effective in the administration of radiogold to patients having viscid or loculated ascites is described. A closed remote system suitable for instilling the material into the pleural or peritoneal cavities is presented. This method was devised to simplify handling, to minimize exposure of personnel to radiation, and to reduce the possibility of spillage and radioactive contamination. (auth)

5287
THE POSSIBLE USE OF NEUTRON-CAPTURING ISOTOPES SUCH AS $BORON^{10}$ IN THE TREATMENT OF NEOPLASMS. II. COMPUTATION OF THE RADIATION ENERGIES AND ESTIMATES OF EFFECTS OF NORMAL AND NEOPLASTIC BRAIN. Manucher Javid, Gordon L. Brownell, and William H. Sweet. J. Clin. Invest. 31, 604-10(1952) June.

Data are presented to show the degree to which intravenously injected borax concentrates in malignant brain tumors and in normal tissues including brain. On the basis of these data for boron and those from other sources for other elements the amount of biologic radiation damage (relative biologic efficiency × rep/min) arising from each element consequent upon exposure to a beam of slow neutrons has been computed to a first approximation. The figures reveal that (1) for the expected concentrations in tissue following injection of borax, the locus of the boron atom would be the principal determinant of the site of damage; and (2) at the readily achieved differential concentrations between glioma and brain of 3.3:1, the radiation damage in tumor would be about 3 × that in normal brain — if one assumes uniform distribution of the neutron flux. (auth)

5288
INDICATIONS AND CONTRAINDICATIONS FOR TREATMENT OF THYROID CANCER WITH RADIOACTIVE IODINE.

William H. Beierwaltes. Ann. Internal Med. 37, 23-30(1952) July.

Review of the literature covering the first 10 yr of I^{131} treatment of thyroid neoplasm and review of the author's cases treated since 1946 have revealed certain criteria to be of definite value in the selection of patients for I^{131} therapy. To be a suitable candidate a patient first should have had a total thyroidectomy, with radical neck dissection when indicated. If the surgeon is unable to eradicate all palpable or visible neoplasm, the x-ray therapist should be given a chance to try for cure or palliation if he feels that this mode of therapy might help. When these well-established forms of therapy have been used or deemed no longer helpful, biopsy will suggest that the patient is a good candidate for I^{131} therapy if it demonstrates follicular and alveolar or papillary neoplasm in primary and metastases. Another indication predicting a good response to therapy is demonstrated ability of thyroid cancer to concentrate I^{131} as shown by (1) a positive autoradiograph; (2) a high uptake in the metastasis demonstrated by external γ counting; (3) less than 30% of an administered dose of I^{131} excreted in the urine in the first 48 to 96 hr after the dose, or (4) low level of I^{131} in the circulating blood after a tracer dose of I^{131}. A more nearly complete response can be promoted by increasing the TSH (thyroid stimulating hormone) effect on metastases through total thyroidectomy, thiouracil administration, and exogenous administration of TSH. Temporary contraindications to I^{131} therapy include clinical myxedema, administration of desiccated thyroid or iodides, and the presence of hypoplasia of bone marrow. (auth)

5289

DESIGN AND CONSTRUCTION OF A MULTICURIE COBALT TELETHERAPY UNIT: A PRELIMINARY REPORT. Leonard G. Grimmett, Herbert D. Kerman, Marshall Brucer, Gilbert H. Fletcher, and Jasper E. Richardson. Radiology 59, 19-31 (1952) July.

Design and construction of a 1,000-c teletherapy unit utilizing Co^{60} as a source of radiation is reported. The unit provides an essentially monochromatic γ-ray beam of 1.2-Mev energy. The calculated value of the initial intensity of 1000 c at 50-cm source-skin distance is 90 r/m. The source, source container, protective head and shutter mechanism, and collimating cone and treatment applicators which make up the flexible clinical unit are described in detail.

TRACER APPLICATIONS

5290

Illinois Univ.

THE METABOLISM OF RADIOACTIVE VITAMIN B_{12} BY THE RUMINANT, by B. Connor Johnson and Kendall W. Barbee. [nd] 4p. (AECU-2139)

Co^{60}-labeled vitamin B_{12} excretion by the ruminant has been investigated following both oral and intramuscular administration in two young dairy calves. The results obtained indicate that the vitamin is retained to a much greater extent when given by subcutaneous injection than when given orally. This is in contrast to previous work with the rat, where the amounts retained were similar, although the pathway of excretion was different. (auth)

5291

Rheumatic Fever Research Inst., Northwestern Univ. Medical School

HISTAMINE BIOGENESIS, by Richard W. Schayer. [nd] 17p. (AECU-2160)

An investigation has been made of the source of histamine bound in animal tissues. No C^{14}-histamine could be detected in the organs of guinea pigs 4 hr after injection with radioactive histamine. After injection with radioactive L-histidine, C^{14}-histamine could be detected in urine and internal organs for many days. A discussion of histamine formation and turnover is presented. (auth)

5292

Brookhaven National Lab.

THE PREPARATION OF RADIOACTIVE IODINATED SERUM ALBUMIN, by Leo Lutwak. [nd] 5p. (BNL-1201)

A rapid procedure for the preparation of radioactive iodinated human serum albumin suitable for injection for dilution studies has been described. This technique used ion-exchange resins instead of dialysis for the removal of free inorganic iodide. (auth)

5293

A METHOD FOR RADIOAUTOGRAPHIC LOCALIZATION OF ISOTOPES IN TISSUES. H. W. Diserens and O. Hall. Texas Repts. Biol. Med. 10, 286-94(1952) Summer.

A method for the production of tissue radioautographs is described in detail. Major advantages to be derived from the technique are reported to be: preparation of the autograph and staining procedures are independent, tissue and autograph may be viewed simultaneously, staining procedures employed require a minimum of time and the emulsion does not stain so intensely as to obscure detail of cellular components, the use of nuclear-track plates permits a close juxtaposition of tissue and emulsion throughout the entire procedure by direct application of sections to the emulsion, and the method is rapid and precise and results in autographs with superior resolution when compared to those produced by other methods.

5294

AGRICULTURAL RESEARCH. Pt. XII of THE RADIOISOTOPE. AEC Isotopes Div. Cyril L. Comar, tech. adviser. 1952. 16 mm film (PMF 5147b). B & W, sound, running time: 25 min. (cf. NSA 6-2840)

Three classes of research are shown in this film: the use of P^{32} in large-scale field tests of fertilizers; the use of Co^{60} in micro-nutrient studies with large domestic animals; and the use of Ca^{45} in major nutrient problems. In many types of agricultural studies it is necessary to determine the proportional contribution of an element by two or more element sources. A numerical example is cited, involving the uptake of P from fertilizer. Using the specific activities of the fertilizer and plant, the plant's proportional uptake of fertilizer P is determined. Co in the diet of cattle is next studied. To differentiate between digestion or absorption from the tract, and behavior inside the body, one animal is dosed orally with Co^{60}, another intravenously. The complete experiment is shown from the time the animals are brought to the nutrition barn to the time their tissues and excretions are analyzed. A related study concerning the incorporation of inorganic Co into vitamin B_{12} is also demonstrated, with sheep as the experimental animal. The third class of investigation involves the behavior of Ca in animals. Studies are shown with swine and poultry. Autoradiography is demonstrated. The film in concluding mentions other ways in which radioisotopes are used in agricultural research. Health-safety procedures and techniques unique to large-scale field and animal research are stressed throughout the film.

5295

A COMPARISON OF RATES OF INCORPORATION AND OF THE α-CARBON ATOM OF GLYCINE INTO HEMOGLOBIN. Kurt I. Altman, Thomas R. Noonan, Sanford C. Spraragen, and Kurt Salomon. Federation Proc. 11, (1952) Mar.

The rates of incorporation of the α-carbon atom of glycine into hemin and globin have been shown to vary independently under such diverse experimental conditions as x radiation and starvation (Noonan et al., Federation Proc. 8, 119(1949); Richmond et al., J. Biol. Chem. 190, 817(1951)). It seemed of interest, therefore, to determine whether the

rate of incorporation of Fe into hemin parallels the rate of incorporation of the α-carbon atom of glycine into protoporphyrin. For this purpose, young adult rats were injected intraperitoneally with α-C^{14}-glycine (3 μc) and with Fe^{59} (0.5 μc) and were sacrificed at varying time intervals. For each time interval the pooled erythrocytes from two or three rats were used to prepare crystalline hemoglobin. An aliquot of this hemoglobin preparation was ashed and used to determine Fe^{59} concentration, while the remainder was used to prepare dimethylprotoporphyrin and globin for the determination of C^{14} activity. The data indicate that the ratio of Fe^{59}/protoporphyrin-C^{14} activities remains nearly constant in the normal animal over a period of 48 hr after the injection of the isotopes. The greatest increase in isotope concentration in Fe as well as in protoporphyrin and globin occurs during the time interval between 24 and 48 hr after injection of the isotopically labeled materials. (Entire report)

5296
PHOSPHORUS-32 LABELING OF THE SCREW-WORM FLY. R. D. Radeleff, R. C. Bushland, and D. E. Hopkins. J. Econ. Entomol. 45, 509-14(1952) June.

A technique is described for marking screw-worms with P^{32} so that released flies and their eggs can be distinguished from the normal population in field studies on the biology and control of this insect.

CHEMISTRY

5297
Carbide and Carbon Chemicals Co. (Y-12)
LITERATURE SEARCH ON SELECTED PROPERTIES OF THORIUM OXIDE, by Frances Sachs. Feb. 22, 1952. Decl. with deletions July 29, 1952. 21p. (AECD-3423; Y-847)

The bibliography contains 42 selected titles on the preparation of, dissolution of, precipitants for, and radiation effects on ThO_2.

5298
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP and NUCLEAR CHEMISTRY (ORGANIC) GROUP, p.103-52 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 50p. (AECU-2128(p.103-52))

Brief report is made of results and status of the following solvent-extraction studies: behavior of Ge(IV) and Ga(III) chloride in the β, β′-dichlorodiethyl ether–HCl system; a procedure for separation of Mn from Fe for fast-neutron threshold detection; and chloro complexes of tetravalent Te. Several aspects of ion exchange with solid membranes made from ion-exchange materials are outlined. In radiochemical studies of the fission process it has been found that the 9-hr activity in the Rh fraction is probably a contamination, and evidence was obtained for a shorter-lived isomer of 2.8-hr Cd^{117}. A new rule is proposed to determine the nuclear charge of the primary fission fragments. The probability of neutron emission from fission products is discussed at length. X rays of maximum energy ~17 Mev are being used to study photofission of U; the yields obtained to date are tabulated. Report is made of the identification of ~25-hr Pm^{151}. The relative yields of isomeric pairs in several different nuclear reactions have been investigated as function of bombarding-particle energy. Chemical procedures for separation of the elements from Cr through As are outlined; this is part of a study of γ-induced spallation of elements from Cu through As. A discussion is presented of shell effects in the nuclear energy surface. The report of the Nuclear Chemistry (Organic) Group deals with the following: carbonium ion structure and rearrangements as studied with tracers; hydrogen isotope effects in solvolytic reactions; and results of determinations, by isotope-dilution techniques, of the isomer distribution in the nitration of halobenzenes.

5299
Illinois Univ.
CARBON ISOTOPE EFFECTS IN THE DECARBOXYLATION OF MALONIC ACID AND BROMOMALONIC ACID, by Peter E. Yankwich and Edward C. Stivers. [nd] 20p. (AECU-2146)

The intramolecular isotope effects in the decarboxylation of C^{13}- and C^{14}-carboxyl-labeled malonic and bromomalonic acids have been determined. The observed C^{13} effect is in agreement with the results of other investigators; the C^{14} effect is in partial agreement with earlier published results of one of the authors. The ratio of C^{14} to C^{13} effects is found to be near 3.5. The intermolecular isotope effect in decarboxylation has been measured for the C^{14}-carboxyl-labeled bromoacid, and found to be consistent with similar results obtained earlier with the normal unsubstituted acid. (auth)

5300
Brookhaven National Lab.
STUDIES IN THE MECHANISM OF THE WILLGERODT REACTION II. DIRECTION OF MIGRATION OF THE FUNCTIONAL GROUP IN ALIPHATIC KETONES, by Edward Cerwonka, R. Christian Anderson and Ellis V. Brown. Brookhaven National Lab. and Fordham Univ. [nd] 8p. (BNL-1205)

The direction of migration of the functional group during the transformation of normal aliphatic ketones into amides by the Willgerodt reaction has been studied with C^{14}. For unsymmetrical di-n-alkyl ketones the functional group shows a preferential tendency to migrate to the shorter end of the chain. This preferential tendency gradually increases as the number of carbon atoms is increased in the longer alkyl chain. (auth)

5301
Texas Univ.
TECHNICAL REPORT TO THE OFFICE OF NAVAL RESEARCH ON THE ELECTROCHEMICAL POLARIZATION OF TITANIUM IN NaCl SOLUTIONS, by Norman Hackerman and Colby D. Hall, Jr. June 1, 1952. 55p. (NP-3961; U22757)

Cathodic and anodic polarizations of Ti in neutral NaCl solutions were measured at constant current densities of 2×10^{-5} to 1×10^{-2} amp/cm^2 by a direct method in a circular-path apparatus. Time-potential curves for cathodically polarized Ti in aerated 0.5M NaCl solutions at current densities up to 6×10^{-5} amp/cm^2 increased slowly from −0.25 v and became almost constant in 1 to 3 days. Initial potentials were more negative for higher current densities and the time to reach a constant potential was longer. At high current densities (above 2×10^{-4} amp/cm^2), the potential did not deviate greatly from the initial value and became constant in a few hours. Time-potential curves for 0.1 and 2.0M NaCl were substantially identical to those for 0.5M NaCl at a given current density. Cathodic-polarization curves for 0.1, 0.5, and 2.0M NaCl were essentially the same; the open-circuit potentials were +0.18, +0.17, and +0.20 v, respectively. A rapid potential decrease occurred near 10^{-4} amp/cm^2; at higher current densities, the logarithmic polarization curve was linear with a slope of 0.204 corresponding to the constant in the Tafel equation. At 2×10^{-4} amp/cm^2 and above, H evolved on Ti. In deaerated 0.5M NaCl, the O diffusion cur-

rent was 2×10^{-6} amp/cm^2, the Tafel-line slope was 0.15, and the H overvoltage was 0.84 v at 1 ma/cm^2. Anodic time-potential curves for aerated 0.5M NaCl increased linearly from about −0.25 v to a constant value between 2×10^{-8} and 2×10^{-5} amp/cm^2; at higher current densities, the potential rose rapidly to a constant value and then increased to a second constant value. O evolution commenced in all anodic runs when the potential reached the first constant value; visible evolution ceased during the second potential increase. (NRS abst.)

5302

Columbia Univ.

PROGRESS REPORT [ON] COLLOIDAL CHARACTERISTICS AND BEHAVIOR OF SOME FLORIDA PHOSPHATE SLIMES, by Victor K. La Mer and Robert H. Smellie, Jr. Issued June 30, 1952. 33p. (NYO-3286)

Research is reported on the fundamental colloidal properties of the U-bearing phosphate slimes with a view to obtaining fundamental data which would be of aid in the development of processes for the beneficiation of the U-bearing fractions. The work covered the flocculation and settling of slimes as a means of dewatering them and a summary of analytical methods.

5303

Radiation Lab., Univ. of Calif., Berkeley

THEORETICAL CONSIDERATIONS ON CELL SHAPE, CONVECTION; AND AN AREA ANOMALY PERTINENT TO DEVELOPING A MOVING BOUNDARY THEORY FOR ULTRACENTRIFUGATION, by Rodes Trautman. July 8, 1952. 32p. (UCRL-1869)

The intuitive concept that a sector-shaped centrifuge cell is free from convection is criticized. Not only is a form of convection present for a single sedimenting species, but a more insidious type occurs in a mixture having an appreciable Johnston-Ogston effect. Rather than striving for convection-free sedimentation, the proposal is to utilize if possible an apparently harmless type of convection occurring in a very thin annulus in order to avoid the convection extending between boundaries in a mixture. The requirement that the concentrations be independent of time meets this condition and yields a hyperbolic cell, which is approximated by a sector cell placed in the rotor backwards. Simultaneously, area measurements and calculations involving the Johnston-Ogston anomaly are simplified because of the time independence. Hyperbolic centrifugation requires a concept of the sedimentation coefficient s based on the velocity per unit field of the net mass transport across any level, rather than the classical velocity per unit field of each and every particle. This concept of s allows description of centrifugation by the law of conservation of mass on an apparatus level ("macroscopic") which is thus different from the atomistic ("microscopic") theories relating an observed s rate to the molecular weight of a single particle. In order to show in contrast the theoretical simplification offered by the hyperbolic cell, the classical equations for the sector cell are derived. (auth)

5304

THERMOMAGNETIC STUDY OF THE PALLADIUM-HYDROGEN SYSTEM AND PALLADIUM-BASE ALLOYS WITH DIAMAGNETIC METALS. J. Wucher. Ann. phys. (12) 7, 317-59(1952) May-June. (In French)

The thermal variations of the magnetic susceptibilities of the H-Pd system and of the solid solutions of Pd with Cu, Ag, Au, Al, Sn, Pb, and Sb were studied. With the exception of Pd_3Ag_2 and Pd_3Cu_2, most of the alloys follow the Curie-Weiss law. The curie constant C of pure Pd, the linear variation of C as a function of H/Pd in the H-Pd system, and the curvilinear variation of C as a function of electron concentration in the alloys can be interpreted by the following hypotheses: (1) Pure Pd consists of an equilibrium mixture of 32.5 ions in the d^9 state and 67.5 atoms with filled shells. (2) Insertion of two H atoms results in the disappearance of a d^9-state Pd ion. (3) In the alloys the number of d^9 ions varies linearly with the electron concentration c_e and becomes zero for $c_e = 0.725$. Relative positions of ions and atoms are discussed.

5305

OBSERVATIONS ON SEVERAL COMPOUNDS OF LITHIUM AND OXYGEN. I. Alvin J. Cohen. J. Am. Chem. Soc. 74, 3762-4(1952) Aug. 5.

A new method of preparation for $LiO_2H \cdot H_2O$ ($Li_2O_2 \cdot H_2O_2 \cdot 2H_2O$) is described. The formula $Li_2O_2 \cdot H_2O_2 \cdot 3H_2O$ for this compound is discounted. Cell constants, densities, and possible space groups are reported for $LiO_2H \cdot H_2O$ and Li_2O_2. X-ray-diffraction studies indicate that LiO_2H and Li_2CO_4 do not exist at room temperature. A dehydration study showed that no fractional hydrate of less than one exists for LiOH.

5306

CONTRIBUTIONS TO THE CHEMISTRY OF THE ELEMENTS NIOBIUM AND TANTALUM. IX. EQUILIBRIUM PRESSURE OF NIOBIUM TETRACHLORIDE DISSOCIATION. Harold Schäfer, Lisel Bayer, and Heimbert Lehmann. Z. anorg. u. allgem. Chem. 268, 268-78(1952) June. (In German)

The dissociation $2NbCl_4(s) \rightleftharpoons NbCl_3(s) + NbCl_5(g)$ was investigated. The pressure of $NbCl_5$ prevailing over solid $NbCl_4$ and $NbCl_3$ was measured with a dew-point method, and evaluated thermochemically. A re-evaluation of literature data on the saturation vapor pressure over solid and liquid $NbCl_5$ was found to be necessary.

ANALYTICAL PROCEDURES

5307

Oak Ridge National Lab.

EFFECT OF FLUORIDE ON THE GRAVIMETRIC DETERMINATION OF ZIRCONIUM IN ZIRCONIUM FLUORIDE, by R. L. McCutchen and C. D. Susano. June 3, 1952. Decl. July 29, 1952. 20p. (AECD-3422; ORNL-1307)

The results of this investigation show that it is necessary to remove fluoride prior to precipitating zirconium with mandelic acid or phenyl arsonic acid. Fluoride, however, has little effect on the cupferron method of precipitation. The discovery that zirconium fluoride is soluble in a mixture of aqua regia and sulfuric acid made it possible to dissolve the material without the addition of fluoride from hydrofluoric acid. (auth)

5308

Carbide and Carbon Chemicals Co. (Y-12)

DETERMINATION OF NITROGEN PRESENT AS AMMONIA AND NITRATE IN URANYL SULFATE AND URANIUM OXIDES, by W. B. Wright, Jr. Nov. 23, 1951. Decl. with deletions July 29, 1952. 19p. (AECD-3426; Y-852)

N present as ammonia and nitrates in uranyl sulfate and in U oxides may be determined with satisfactory accuracy and precision by the method described. Nitrates are reduced to ammonia by Devarda's alloy, then the free ammonia is removed by distillation in a modified micro-Kjeldahl unit and determined spectrophotometrically with a modified Nessler's reagent. Variables which affect the accuracy and precision are discussed and compared with previously reported results. Nitrates and ammonia in U metal may also be determined by the method. With microgram quantities of N the limit of error is less than 10%. (auth)

5309

Oak Ridge National Lab.

METHODS OF DETERMINATION OF URANIUM TRIFLUORIDE, by D. L. Manning, W. K. Miller, and R. Rowan, Jr. Apr. 25, 1952. Decl. July 29, 1952. 19p. (AECD-3427; ORNL-1279)

The determination of the purity of synthetic UF_3 has been accomplished in this laboratory by two independent methods. One method is based on the determination with ceric sulfate of the total reducing power of the sample, while the other depends on the measurement of the volume of H_2 evolved when the sample is treated with HCl. (auth)

5310

Oak Ridge National Lab.

PRELIMINARY INVESTIGATION OF MONOCHROMATIC X-RAY ABSORPTION AS A METHOD OF ANALYSIS FOR URANIUM, by W. F. Peed and H. W. Dunn. Apr. 8, 1952. Decl. July 29, 1952. 19p. (AECD-3429; ORNL-1265)

Preliminary data have been taken to evaluate x-ray absorption at the L III edge of U as a method of detection of U in solution. U concentrations in water from 150 to 30,000 ppm have been investigated. The effect of Cu as a typical contaminant in the range 737 to 36,850 ppm of Cu has been investigated for a representative U solution. Instrumentation has been constantly improved, and suggestions for further improvements in amplifying and counting equipment are included. Comparison of experimental data with theory indicates that the derived equations are adequate. (auth)

5311

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

CHEMISTRY OF THE FISSION ELEMENTS GROUP, p.1-14 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 14p. (AECU-2128(p.1-14))

The report consists of brief summaries on the results and current status of the following investigations: polarographic studies of thiocyanate complexes of Zn and cyanide complexes of Cd; spectrophotometric studies of chloride complexes of Cu and carbonate complexes of Ce; colorimetric determination of microgram quantities of Nb; polarographic reduction of In in nitrate and perchlorate media; improvements in apparatus for flame photometry; preliminary experiments with thermometric titrations; determination of trace amounts of Ag by its catalytic effect; fluorimetric determination of Sm; preliminary studies with a high-frequency titrimeter; polarography with stationary electrodes; electrodeposition behavior of Tl and Cd at a Hg cathode; spectrophotometric determination of heavy metals; and separation of the rarer metals by distillation of their halides.

5312

[Knolls Atomic Power Lab.]

THE DETERMINATION OF FREE ACID CONCENTRATION IN THE PRESENCE OF HYDROLYZABLE IONS, by Leonard P. Pepkowitz, William W. Sabol, and Dragomir Dutina. [nd] 15p. (AECU-2140)

A conductometric titration procedure is described for the determination of free H ion in complex solutions containing hydrolyzable ions such as Fe, Ni, Cr, Al, and Mg. The method has been applied to HNO_3, H_2SO_4, or mixtures of these acids in presence of the ions listed above. The method is based on the conductometric titration of the free H ion by a strong base (NaOH) in the presence of a complexing agent (NaF). Typical strong acid-strong base curves were obtained. A standard deviation for precision of ±0.0016 was obtained in the range of 0.038 to 0.006 millimoles of acid in the aliquot taken for analysis. The limit of sensitivity was found to be 0.003 millimoles of free acid. Since such small amounts of acid can be handled, the method is applicable to very small aliquots (100 microliters or less) which makes it especially useful for highly radioactive solutions. For instance, 10 microliters of 0.3M H^+ can be titrated. When possible, however, 0.01 millimoles of acid should be the minimum amount used for an analysis. A variation of the procedure is described for the determination of acid deficiency in salt solutions. The generalized application of the procedure is dependent on finding an adequate complexing agent which will prevent hydrolysis at the acid-base end point. (auth)

5313

Hanford Works

THE DETERMINATION OF URANO-URANIC OXIDE IN URANIC OXIDE, by H. H. Van Tuyl. June 13, 1952. 17p. (HW-24700)

Urano-uranic oxide (U_3O_8) can be determined in uranic oxide (UO_3) by weighing the residue after hydrochloric acid dissolution, or by determining total uranium or uranium(IV) in this residue. Uranium(IV) can be determined directly by dissolving the UO_3 in phosphoric acid or mixtures by phosphoric and sulfuric acids, and measuring the uranium(IV) content spectrophotometrically. All of these methods are discussed, and investigations of many variables are presented. The best method for determining U_3O_8 in UO_3 containing other impurities that are insoluble in hydrochloric acid, is the determination of uranium(IV) in the residue after hydrochloric acid dissolution. Hydroxylamine is added with the hydrochloric acid to prevent oxidation of U_3O_8 by nitric acid. The residue is washed with water to remove excess hydroxylamine and thus prevent reduction of uranium(VI). The residue is dissolved in a mixture of sulfuric and phosphoric acids, and the concentration of U_3O_8 is determined by measuring the concentration of the uranium(IV) ion spectrophotometrically. (auth)

5314

Hanford Works

GUIDE TO APPLICATION OF THE X-RAY PHOTOMETER IN CHEMICAL ANALYSIS, by Maurice C. Lambert. June 20, 1952. 17p. (HW-24717)

The relative absorptions of x rays by various substances are listed as a guide to the application of the x-ray photometric method in chemical analysis and to the estimation of interference by extraneous substances. Small glass cells of fixed path length reduce the sample size from 20 and 50 ml to 2.7 and 7.8 ml, depending on the path length. Various techniques and their advantages or disadvantages are outlined briefly. In the normal method of analysis the absorption of the "sample" beam is matched by attenuating the "standard" beam with Al metal. In differential techniques, absorption by the sample is matched for the most part by a standard solution of similar composition. Precisions obtainable for the determination of various substances are discussed. Analytical errors for the determination of U in a solution containing 40 g of U/liter are shown to be ±0.7% by the normal method and ±0.25% by a modified differential method. Examples are shown of the application of this method to the analysis of single solute systems. Time required for an analysis, once the sample is in solution, is 6 to 8 min. Application of the x-ray photometer for continuous in-line analysis with automatic recording is discussed. (auth)

5315

Pittsburgh Univ.

2-(o-HYDROXYPHENYL)-BENZIMIDAZOLE AS A REAGENT FOR THE DETERMINATION OF MERCURY, by Joseph L. Walter and Henry Freiser. June 16, 1952. 15p. (NYO-3067)

This paper describes a gravimetric and volumetric method for the determination of Hg based on its reaction with a newly developed organic reagent, 2-(o-hydroxyphenyl)-benzimidazole. It was found possible to determine from 10 to 85 mg of Hg with an average accuracy of 0.3 mg using this reagent. The precipitation can be carried out at a pH of 6.8 using citrate ion as a complexing agent in the presence of many of the ions commonly causing interferences with Hg. Ferric ion is the main interference. The precipitate, $Hg(C_{13}H_9N_2O)_2$, is easily filterable and readily brought to

constant weight by heating at 130°C. Hg may be determined volumetrically by means of the reaction of a bromate-bromide mixture with an acetic acid solution of the precipitate. The excess bromine is then titrated with standard Na thiosulfate, using a dead-stop indicator apparatus. (auth)

5316

Syracuse Univ.

AMPEROMETRIC TITRATION METHOD FOR THORIUM IN THE PRESENCE OF THE RARE EARTHS OF MONAZITE SAND, by Louis Gordon and C. Richard Stine. June 24, 1952. 5p. (NYO-3187)

A suitable method for the volumetric determination of Th in the presence of interfering substances has not been available. An amperometric method is described which utilizes ammonium molybdate as titrant. The procedure permits the determination of 10 to 30 mg of Th oxide in the presence of up to 800 mg of rare earth oxides in a volume of 50 ml. Th and the rare earths must be present as chloride. Perchlorate, nitrate, and sulfate ions should be excluded. This titrimetric procedure allows a rapid and accurate determination of Th in the presence of moderately large quantities of rare earths such as in monazite sand. (auth)

5317

RADIOACTIVATION DETERMINATION OF ZIRCONIUM IN Zr-Hf MIXTURES. J. E. Hudgens, Jr. and H. J. Dabagian. Nucleonics 10, No. 5, 25-7(1952) May.

Zr concentration, in Zr-Hf mixtures ranging from nearly pure Zr to as little as a few tenths parts per million, can be determined within about 1% by combining slow-neutron activation and radiochemical separation. Since the amount of Nb^{95} radioactivity formed by bombarding Zr^{94} with neutrons can be determined, and the concentration of Zr^{94} can be calculated from the amount of Nb^{95} radioactivity, an analysis for Zr can be performed without separating it from Hf. A method is described for calculating the Nb^{95} activity present at the end of the neutron irradiation. The steps in the preparation of the sample prior to counting are outlined. For counting, the watch glass containing the Nb oxide precipitate is mounted in the center of an Al tray and covered with a thin sheet of Al. The radioactivity of the sample is determined by using a flow-type counter attached to a scaler. A He (98.7%)-isobutane (1.3%) mixture is used as the counting atmosphere.

5318

PHOTOMETRIC DETERMINATION OF TRACES OF MOLYBDENUM AFTER SULFIDE PRECIPITATION. R. B. Henrickson and E. B. Sandell. Anal. Chim. Acta 7, 57-62 (1952) July. (In English)

A photometric method for traces of Mo in silicate rocks and similar materials is described, in which Mo is isolated as the sulfide from the acidified leach of the Na carbonate melt. Sb_2S_5 is used as collector. Mo is thus separated from P, V, W, U, and some other elements. The final determination is made by the familiar thiocyanate–stannous chloride method with isopropyl ether as extractant. The method is particularly suitable for the determination of Mo in the presence of relatively much W. (auth)

5319

RAPID GRAVIMETRIC DETERMINATION OF BERYLLIUM IN BERYL. J. Huré, M. Kremer, and F. le Berquier. Anal. Chim. Acta 7, 37-41(1952) July. (In French)

After the beryl is dissolved by fusing the powdered mineral with Na peroxide and eliminating silica, Be is precipitated directly in the filtrate by monoammonium phosphate in the presence of complexon II or ethylenediaminotetraacetic acid. Complexon II forms complexes and retains in the solution the other metals contained in beryl, but permits the quantitative precipitation of ammonium phosphate and Be, which is calcined at 1000°C and weighed out as Be pyrophosphate, $Be_2P_2O_7$. (auth)

5320

THE DETERMINATION OF SMALL AMOUNTS OF VANADIUM IN THE PRESENCE OF LARGE AMOUNTS OF URANIUM. S. H. Simonsen. Anal. Chim. Acta 7, 33-6(1952) July. (In English)

To eliminate the color interference of large amounts of U in the determination of V by the Hamner method (Met. Chem. Eng. 17, 206(1917)), the V was separated prior to titration by the extraction of V cupferrate with chloroform. The chloroform extract was evaporated with sulfuric acid, and the excess cupferron was removed by oxidation with nitric acid and perchloric acid. The V was reduced with ferrous ammonium sulfate solution, the excess ferrous ion was oxidized with ammonium persulfate, and the V(IV) was titrated with 0.02N K permanganate. As little as 1.02 mg of V in the presence of 5 g of U oxide was determined accurately by this method. (auth)

5321

ON THE VOLUMETRIC ESTIMATION OF CERIUM BY POTASSIUM PERMANGANATE. G. S. Deshmukh. J. Sci. Research Benares Hindu Univ. 1, 121-4(1951) July.

A simple volumetric method for Ce estimation is described. This consists essentially of the precipitation of cerous oxalate by oxalic acid from faintly acidic solutions of Ce salts, the dissolution of the oxalate in hot dilute H_2SO_4, and its subsequent titration against standard $KMnO_4$. The interference due to the usual contaminants of Ce is obviated by fractional precipitation of cerous oxalate from HCl solutions not exceeding 0.5N. This also ensures a quantitative precipitation of Ce by oxalic acid. Under the given experimental condition 1 ml of 0.05N $KMnO_4$ corresponds to 0.0023347 g of Ce. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5322

Connecticut Univ.

TERNARY COMPOUNDS; FIRST TECHNICAL REPORT FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1952, by Roland Ward, Aaron Wold, Beatrice Gushee, and Dana H. Ridgley. [nd] 46p. (NP-3915; U22515)

Thirty-eight compounds were prepared having the general formula A(III)B(III)O_3, where A represents La, Pr, Nd, or Sm and B is V, Cr, or Co. Both $CeVO_3$ and $CeCrO_3$ were prepared, but attempts to synthesize $CeCoO_3$ were unsuccessful. X-ray patterns from $LaCoO_3$ to $SmCoO_3$ showed a gradual shift from a distorted perowskite or rhombohedral structure to the cubic form. The ABO_3-type compounds were prepared in the range 650 to 1260°C for all combinations of Ca(II), Sr(II), or Ba(II) with V(IV), Cr(IV), Mn(IV), Fe(IV), Co(IV), and Ni(II) trivalent cations except for the Ca-Ni-O system. Compounds containing Ca-Mn-O and Ca-V-O had simple perowskite-like structures; systems Ba- or Sr-V(IV)-O yielded mixtures of phases. The $BaCoO_{2.72}$ (500 to 900°C) and $BaCoO_{2.28}$ (1000 to 1300°C) phases resembled the distorted and simple perowskite structures, respectively. The structures of the former and $BaCoO_{2.31}$ were similar to the perowskites obtained in the Sr-Ni-O, Sr-Co-O, and Ba-Mn-O systems. Single crystals in the Ca- and Sr-Co-O series were made at 1260°C. Heating $BaCO_3$ and Nb_2O_5 (Ba : Nb ratios of 0.5 or 1.0) in a H atmosphere from 1150 to 1180°C produced crystals having almost identical powder-diffraction patterns. The material obtained from heating $SrCO_3$ and Nb_2O_5 gave patterns differing from those of the Ba mixtures. (NRS abst.)

5323

Cornell Univ.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS, by J. L. Hoard. July 1, 1952. 5p. (NYO-929)

A considerable amount of quantitative intensity data from two specimens of the needle-like tetragonal modification of

boron have been measured on an x-ray spectrometer using a convergent beam technique. It appears quite definite that there are nontrivial variations in the pattern of integrated intensities as between the two specimens. Failure of Zachariesen's method to give an approximate structure for the fluorocarbon, C_8F_{12}, has led to abandonment of the assumption of a centrosymmetric structure. A noncentrosymmetric model of the molecule, which gives the best all-around fit with Patterson data, is being tested. The unit cell of dimethylamine-borine dimer is monoclinic with $\underline{a}$ = 6.24, $\underline{b}$ = 11.07, $\underline{c}$ = 6.28 A; β = 98°48′; space group C_{2h}^3, C_s^3, or C_2^3; and contains two molecules. Determination of the structure appears feasible. (auth)

5324

A CORRECTION AND NOTE ON THE RELATION OF THE β-URANIUM AND σ-PHASE STRUCTURES. Charles W. Tucker, Jr. Acta Cryst. 5, 389(1952) May.

In the paper on the crystal structure of β phase of U, the reference to the work of Shoemaker and Bergman on the structure of the σ phase in the Cr-Fe system should be corrected to read 1950 instead of 1951. The complete reference is J. Am. Chem. Soc. 72, 5793(1950). The part of the paper dealing with the relation of the β-U and σ phase structure was intended to discuss this subject alone.

DEUTERIUM AND DEUTERIUM COMPOUNDS

5325

National Bureau of Standards

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1947, by Lawrence M. Brown and Charles W. Beckett. June 1, 1952. 61p. (NBS-1631)

A bibliography of published research on the isotopes of H and their compounds has been compiled from Chemical Abstracts, British Abstracts, and Physics Abstracts for the year 1947. Each entry in the bibliography is listed alphabetically according to its leading author and contains, in addition to its title and literature reference, a subject code symbol designating its content. The bibliography is supplemented by both a compound and a subject index. The arrangement of the bibliography parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945, inclusive. (auth)

5326

National Bureau of Standards

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1948, by Lawrence M. Brown and Charles W. Beckett. July 21, 1952. 78p. (NBS-1685)

This is one of a series of annual bibliographies of published research on the H isotopes and their compounds. The series will include published research on all properties of D and T and their compounds listed in Chemical Abstracts, British Abstracts, and Physics Abstracts for each year, beginning with 1946. At a later date similar bibliographies of governmental reports will be compiled for the period 1946 to 1951, inclusive. The purpose of these bibliographies is to extend a similar bibliography (1932-1945) compiled by Kimball. They will further provide useful references for those engaged in isotopic research, and particularly for those interested in the isotopes of H. (auth)

FLUORINE AND FLUORINE COMPOUNDS

5327

Washington Univ.

THE PHYSICAL PROPERTIES OF SOME FLUORINATED PENTANES; TECHNICAL REPORT (thesis), by Leland L. Burger. [nd] 71p. (NP-3978; U-16337)

Pure samples of (I) perfluoropentane, (C_5F_{12}), (II) perfluoroisopentane, (C_5F_{12}), and (III) perfluorocyclopentane, (C_5F_{10}), were prepared by the method of R. D. Fowler (Ind. Eng. Chem. 39, 292(1947)). Warming-curve studies were used for determining melting and transition points and estimating the energies of transition and fusion. The m.p.'s of paraffin fluorocarbons varied with the chain length. The odd-even alternation in m.p. followed the same pattern as the hydrocarbon. The general behavior of the b.p.'s of fluorocarbons as a function of chain length and mol. wt. is discussed. The m.p.'s and b.p.'s of I, II, and III were –12°, –126°, and –96° and 22.5 ± 1, 29.3, and 30.1°C. Densities of I, II, and III measured from the b.p.'s down to –90°C were 1.620, 1.664, and 1.645, respectively. The density of III was determined over its liquid range; the solid density was estimated as 1.84. Viscosities of the pure liquid I, II, and III at 20°C were 4.94, 6.27, and 7.67 millipoises, respectively. Data were interpreted on the basis of recent viscosity theory. The viscosity of a mixture of I and II was measured and compared with predicted values. Forces between fluorocarbon molecules were relatively small; the effect of small forces on these structures was not similar to that of the analogous hydrocarbons. (NRS abst.)

5328

Washington Univ.

THE LIQUID-VAPOR EQUILIBRIUM OF THE SYSTEM TUNGSTEN HEXAFLUORIDE–PERFLUORO-n-PENTANE, AND SOME RELATED STUDIES; TECHNICAL REPORT (thesis), by Eugene John Barber. Dec. 1948. 119p. (NP-3979; U-2625)

Crude products from the fluorination of n-pentane, isopentane, neopentane, and cyclopentane were fractionally distilled in a column having 82 theoretical plates. Fifteen different products were isolated including pure perfluoro-n-pentane, perfluoroisopentane, perfluoro-cyclo-pentane, and fairly pure 1-H-perfluorocyclopentane. Also isolated were the three monohydroperfluoro-n-pentanes and monohydroperfluoroisopentanes. During the fluorination of neopentane much cleavage occurred and some of the molecules rearranged to give perfluoroisopentane. No perfluoroneopentane was found. A reaction mechanism involving double-bond formation as a probable essential step in the early stages of the fluorination is discussed. Tungsten hexafluoride was prepared from the elements, and some of its physical properties were studied. On the basis of the solid transition at –8.2°C not reported by Ruff, vapor pressure curves giving a satisfactory fit to Ruff's data are proposed; and the heats of transition and fusion have been calculated to be 2290 and 510 cal/mole, respectively. A vacuum-jacketed metal equilibrium still suitable for obtaining liquid-vapor equilibria in fluorocarbon-heavy metal fluoride systems was designed and constructed. Vapor pressures of n-C_5F_{12}, iso-C_5F_{12}, cyclo-C_5F_{10}, n-C_7F_{16}, cyclo-C_5HF_9, CCl_4, and WF_6 were measured from approximately 400 to 2400 mm of Hg and fitted with three constant empirical equations by the method of least squares. The boiling points, the heats of vaporization from the Clapeyron equation, the energies of vaporization, the "internal pressures," and the entropies of vaporization at the boiling point, at 25°C, and at 40°C were calculated. The entropies were also compared at a vapor concentration of 0.0347 moles/liter and at a volume-of-gas to volume-of-liquid ratio of 160. A Hildebrand entropy of vaporization of 22.1 ± 0.2 e.u. was noted for fluorocarbons and WF_6 at a concentration of 0.0347 moles/liter of vapor. The liquid-vapor equilibrium of the system, WF_6–perfluoro-n-pentane, was determined both at 25°C and at 1.5 atm pressure. Comparison between the observed excess free energy and that computed from the simple Hildebrand-Scatchard equation indicates that the former is much less than predicted. Consideration of the excess entropy of mixing of molecules of unlike size and shape reduces the difference but still leaves

the Hildebrand-Scatchard results larger. The difference is in the opposite direction to that predicted by Hildebrand for molecules with radial potential functions in both WF_6 and perfluoro-n-pentane. (cf. NSA 5-6673) (auth)

5329
HIGH VAPOR PRESSURE OF n-HEXADECAFLUOROHEPTANE. H. T. Milton and George D. Oliver. J. Am. Chem. Soc. 74, 3951-2(1952) Aug. 5.

A pressure-temperature plot of the experimental data in the region of the critical point resulted in a line whose slope approached infinity at a temperature of 201.5 ± 0.1°C and pressure of 234 ± 2 p.s.i.a. These critical values check previously reported data on n-hexadecafluoroheptane determined by another method.

5330
INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHYLENES. IV. 1,1-DIFLUORO-2-CHLOROETHYLENE. J. Rud Nielsen, C. Y. Liang, and D. C. Smith. J. Chem. Phys. 20, 1090-4(1952) July.

The infrared absorption spectra of gaseous and liquid CF_2=CHCl have been obtained in the regions 2 to 22 and 2 to 38 μ, respectively, with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of the liquid phase has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. Relative intensities and depolarization ratios have been measured for the stronger Raman bands. A complete assignment of fundamental vibration frequencies is given, the spectra are interpreted in detail, and thermodynamic functions are calculated for the temperature range 253 to 600°K. (auth)

5331
THE ENTROPY OF FLUORINE. George M. Murphy and E. Rubin. J. Chem. Phys. 20, 1179-80(1952) July.

Experimental determinations of the entropy of fluorine from heat capacity data are 2.46 eu/mole lower than that calculated by the statistical method. The original data are reexamined, and the results are compared with those of several researchers. A possible explanation of the discrepancy is proposed.

5332
INFRARED SPECTRUM OF GASEOUS HYDROFLUORIC ACID BETWEEN 1400 AND 700 CM^{-1}. R. Coulon. J. phys. radium 13, 371-2(1952) June. (In French)

The infrared absorption curves of gaseous HF at 20°C at 190 and 380 mm Hg pressure are shown. Three bands appear; the most intense is at 1025 cm^{-1}, and two others are at 1170 and 750 to 800 cm^{-1}. The great variation in intensity with pressure suggests association.

5333
PHYSICAL PROPERTIES OF PERFLUORO-n-HEXANE AND PERFLUORO-2-METHYLPENTANE. Vernon E. Stiles and George H. Cady. J. Am. Chem. Soc. 74, 3771-3 (1952) Aug. 5.

Samples of two isomeric perfluorohexanes have been prepared by the fluorination of the pure hydrocarbons with CoF_3. The resulting crude products were fractionally distilled, and the best cuts of each were combined. These were used for determinations of melting point, vapor pressure, surface tension, viscosity, density, and index of refraction. Of the two compounds the normal fluorocarbon is the less dense, the less viscous, and the more volatile. Its surface tension and index of refraction are the lower. The liquids are very much alike, but their physical properties differ from each other somewhat and in directions opposite to those for the corresponding hydrocarbons. In this respect they resemble perfluoro-n-pentane and perfluoroisopentane.

GRAPHITE

5334
THE VAPORIZATION OF GRAPHITE FILAMENTS. Milton Farber and Alfred J. Darnell. J. Am. Chem. Soc. 74, 3941-2(1952) Aug. 5.

A value of 177.2 ± 1 kcal/mole for the ΔE_0^0 of sublimation of graphite was calculated from data on the rate of evaporation of a cylindrical filament in the temperature range 2400 to 2900°K. Values of αp, the accomodation coefficient multiplied by the vapor pressure, are tabulated. The question of the value of α is still unresolved.

LABORATORIES AND EQUIPMENT

5335
[Atomic Energy Research Establishment, Harwell, Berks (England)]
SIMPLE METHOD OF DRYING HYDROGEN, NITROGEN AND ARGON, by E. R. Harrison. June 12, 1951. 3p. (AERE G/M-89)

The gases were dried on a small scale for a wide range of processes by passing them through a K-Na alloy trap. The alloys between 33 to 19% Na and 67 to 81% K have melting points at 0°C or lower and are liquid at room temperatures. The trap consists of a large glass U tube containing the liquid alloys, and an outer protective container, a 24-in.-long by 6-in.-diameter pyrex tube. The trap has the advantage of being a standard piece of apparatus and always ready for immediate use.

5336
Atomic Energy Research Establishment, Harwell, Berks (England)
INTENSE PURIFICATION OF GASES WITH ALKALI METALS, by E. R. Harrison. Apr. 6, 1952. 5p. (AERE G/M-129)

A method for the intense purification of such gases as N, H, and the rare gases in a simple and readily constructed piece of apparatus is described. The gas to be purified is mixed with K vapor and swept through a gas-permeable, finely divided substance such as glass wool. The K vapor condenses in a highly reactive form, thus creating an efficient and continuously activated system for scrubbing the gas. Simple tests, utilizing a specially designed apparatus, showed that the water vapor content of N gas was reduced to one part in 2×10^7 by volume at a rate of flow of 500 cm^3/min. (auth)

5337
Walker Lab., Rensselaer Polytechnic Inst.
A MODIFIED KARL FISCHER TITRATION CELL, by Donald E. Campbell. July 9, 1952. 4p. (NYO-3565)

The cell is constructed from a 250-ml Erlenmeyer flask fitted by means of a 34/45 joint to an adapter containing the electrodes and the buret tips. More space in the adapter cap was made available by employing a magnetic stirrer rather than a motor-propeller stirrer, and by changing the location of the breather tube. The breather tube is located in the upper part of the flask so that it can also be used as a port for introducing liquid samples by pipet. This eliminates the necessity of removing the titration vessel for the introduction of the sample and thus exposing the system to atmospheric moisture. After the sample is introduced, and during the titration, the system is protected from moisture by a drying tube connected to the breather tube by a 10/30 joint. Rather than sealing in a set of electrodes, two 14/20 female joints were sealed into the caps into which suitably adapted electrodes are fitted.

5338
MOBILE RADIOCHEMICAL LABORATORY. J. Kohl and R. L. Newacheck. Nucleonics 10, No. 5, 44-5(1952) May.

Facilities for chemical analysis, sample preparation, and radioactivity counting of samples are included in a 22-ft trailer designed by Tracerlab, Inc. for the Department of Defense. This mobile laboratory, which also carries its own utilities, makes possible field measurements and evaluations of radioactivity that are impossible with ordinary portable instruments. The trailer is divided into three rooms, each 87 in. wide and 75 in. high. The utility room is 74 in. long, the chemistry laboratory 90 in. long, and the counting room 76 in. long. The last two rooms are joined by a sliding door. Thermostat-controlled air conditioning and heating are both provided. The ventilating ducts have been designed so that for cooling, air is supplied at the ceiling, and for heating, warm air is supplied at floor level.

5339
HOOD FOR RADIOACTIVITY WORK. S. H. Webster, E. J. Liljegren, and C. C. Powell. Nucleonics 10, No. 4, 65-8 (1952) Apr.

The characteristics of the hoods are ample working space, easy decontamination, good visibility, sturdy construction, and removal of toxic fumes and dusts without possibility of these materials entering the room. The working surface is a stainless-steel watertight pan or tray provided with a trough along the rear edge and an opening into the radioactivity drain. The superstructure, baffles, aprons, front and side panels, and countertop are fabricated of sanded cement-asbestos board treated with a black resin coating. The minimum thickness of all the material is ⅜ in. Air, gas, vacuum, cold and hot water, and steam are furnished. The hood blowers can exhaust 900 ft^3/min at a pressure of 10 in. of water.

5340
RADIOCHEMICAL LABORATORIES; THEIR DESIGN AND LAYOUT. J. W. J. Fay. Mfg. Chemist 23, 273-7(1952) July.

Although the handling of large quantities of radioactive materials such as is carried out at the major atomic energy plants frequently requires the use of elaborate and expensive laboratories and equipment, the employment of much smaller quantities for research applications does not necessarily entail such facilities. The substitution of glove boxes for normal hoods and benches in particular can largely solve the problem at a fraction of the cost of conventional methods. This article reviews the design and layout of radiochemical laboratories with particular emphasis on this trend. (auth)

MOLECULAR STRUCTURE

5341
STRUCTURE OF THE METHYL HALIDES. S. L. Miller, L. C. Aamodt, G. Dousmanis, C. H. Townes, and J. Kraitchman. J. Chem. Phys. 20, 1112-14(1952) July.

Microwave spectroscopic measurements on the partially deuterated forms of CH_3Cl, CH_3Br, and CH_3I allow a determination of the structural parameters which is less subject to zero-point vibration errors than other methods. In addition, examination of all measured isotopic species reveals that the C–D distance is shorter than C–H by 0.009A, and the D–C–D angle greater than that for H–C–H by about 12 min. Best values of structural parameters for the species containing the light isotope of hydrogen only are C-Cl distance, 1.781; C–Br, 1.939; C–I, 2.139; C–H, 1.11 (same for all halides); H–C–H angle, 110°31′ for CH_3Cl, 111°14′ for CH_3Br, and 111°25′ for CH_3I. Deuteration not only gives a change in the C–H bond but also a well-correlated change in the quadrupole coupling constant of the halogen. (auth)

RADIATION CHEMISTRY

5342
Wisconsin Univ.
EVIDENCE OF PARTIAL FAILURE OF THE Br^{80} ISOMERIC TRANSITION TO RUPTURE CARBON-BROMINE BONDS, by R. S. H. Chiang and J. E. Willard. [nd] 13p. (AECU-2154)

The efficiency of the Br^{80m} (4.4 hr)→ Br^{80} (18 min) isomeric transition in breaking the C–Br bond has been determined for five organic bromides. It is found to be less than 100% in four of the cases and to be determined in part by the substituents on the C atom and in part by whether the compound is in the liquid or gas phase. The approximate values for failure to rupture are: CCl_3Br_{gas}, 7%; CH_3Br_{gas}, 6%; CF_3Br_{gas}, 1%; CCl_3Br in liquid Br, 13%; CH_3Br in liquid Br, 6%; C_6H_5Br in liquid Br, 13%. (auth)

5343
THE EFFECT OF OXYGEN ON A RADIOREDUCTION REACTION. Norman Todd and S. L. Whitcher. J. Chem. Phys. 20, 1172-3(1952) July.

Solutions of K iodate in water, H_2SO_4, and neutral and alkaline solutions were irradiated with x rays, and the effect of air saturation and air removal on the reduction products was studied.

RADIATION EFFECTS

5344
Brookhaven National Lab.
THE RADICAL PAIR YIELD OF IONIZING RADIATION IN FERROUS SULFATE AND CERIC SULFATE SOLUTIONS, by Everett R. Johnson. [nd] 11p. (BNL-1209)

The radical pair yield from dilute aqueous solutions of ferrous sulfate and ceric sulfate solutions has been determined. Using the mechanism of Weiss et al. (Proc. Roy. Soc. (London) A211, 375(1952)) for the H formation in deaerated solutions of ferrous sulfate it is found that 23% of the radicals recombine to yield stable products in good agreement with values obtained by others. Two results are found for the reduction of ceric sulfate solutions, depending on the wave length of x rays used. This indicates that the mechanism postulated for this reaction is not entirely correct. Further contradictions are found in the longer-x-ray case when the H yields are considered. These results show that hydroxyl radicals must undergo some other reaction besides that with each other to yield O_2 and H_2O. (auth)

5345
Los Alamos Scientific Lab.
CHEMICAL EFFECTS PRODUCED IN $CHCl_3$ BY GAMMA RAYS, by John W. Schulte, John F. Suttle and Richard Wilhelm. June 1952. 30p. (LA-1438)

A complete study is made on the effect of γ radiation upon the decomposition of pure dry chloroform in an atmosphere of O_2.

5346
Radiation Lab., Univ. of Calif., Berkeley
HIGH ENERGY HELIUM-ION IRRADIATION OF FORMIC ACID IN AQUEOUS SOLUTION, by Warren M. Garrison, Donald C. Morrison, Herman R. Haymond, and Joseph G. Hamilton. June 13, 1952. 7p. (UCRL-1857)

H_2-saturated aqueous solutions of C^{14}-labeled formic acid were bombarded by the 40-Mev He-ion beam of the 60-in. cyclotron. Experimental techniques are described.

A combination of paper chromatography and radioautography demonstrated the production of oxalic acid, formaldehyde, and at least eight other organic compounds by the reaction.

5347
RADIATION-INDUCED DECOMPOSITION OF CERTAIN ORGANIC MOLECULES IN SOLUTION. Marilyn Grace Alder and Henry Eyring. Nucleonics 10, No. 4, 54-7(1952) Apr.

A mechanism for the radiation-induced decomposition of solute in dilute aqueous solution is proposed, and an expression for the ionic yield as a function of the initial solute concentration and the O_2 concentration is derived. Experimental data obtained by irradiation of aqueous solutions of glutathione and fluorescein with x rays, aqueous and petroleum ether solutions of certain vitamins with x rays and electrons, and aqueous solutions of the enzyme carboxypeptidase with x rays and α particles are analyzed in terms of the proposed mechanism.

RARE EARTHS AND RARE-EARTH COMPOUNDS

5348
Argonne National Lab.
ABSORPTION SPECTRA OF LANTHANIDE AND ACTINIDE RARE EARTHS. II. TRANSITION PROBABILITIES FOR +3 IONS IN THE TWO SERIES, by D. C. Stewart. Feb. 1952. 21p. (ANL-4812; AECD-3351; ANL-WMM-960)

An abstract of this report was indexed as report AECD-3351 and appears in Nuclear Science Abstracts as NSA 6-3418.

SORPTION PHENOMENA

5349
William H. Chandler Lab., Lehigh Univ.
HETEROGENEITY OF SURFACES, ADSORPTION OF GASES ON METALS; MOLYBDENUM AND THE THERMODYNAMICS OF ADSORPTION; OFFICE OF NAVAL RESEARCH TECHNICAL REPORT NUMBER 4; 1 JUNE 1951 TO 31 MAY 1952. [nd] 77p. (NP-3933; U22550)

High-pressure measurements: A procedure for reducing and degassing Mo powder was developed which gave a metal surface apparently free of chemisorbed O and H. Reductions at an H pressure of 1 atm. and at 500° to 600°C produced a surface which readily chemisorbed O at room temperature; at −195°C, 10 to 20% of the surface was chemically active toward O. Physical surface heterogeneity, as determined by A adsorption measurements, tended to disappear with successive sinterings of the metal powder. For a specimen which had undergone one reduction, half of the uptake at 195°C was attributed to physical heterogeneity. The apparent heterogeneity resulting in chemisorption of the remaining O seemed due to some inherent property of the metal, possibly electron affinity. The same V_m values were obtained for the physical adsorption of A, N, and O in reduced powder at −183°C and −195°C; those for CO on reduced metal were anomalous. Exposure of Mo metal to dry O at room temperatures produced a monomolecular MoO_2 film; exposure to wet O gave a polymolecular oxide film, believed to be $MoO_2 \cdot 4MoO_3 \cdot xH_2O$. Low-pressure measurements: Isotherms were obtained at 0.1 μHg with a modified McLeod gage. The application of thermal transpiration corrections to physical adsorption data changed the calculated values at the lowest pressure by about 200 cal. Isosteric and equilibrium heats of adsorption were measured for N and A on reduced and unreduced Mo surfaces and for O and CO on unreduced Mo. At low surface coverages, the heats of adsorption for both N and CO on unreduced powder were approximately 3.5 kg-cal. The initial heats of adsorption of N and A for the reduced metal were 0.9 kg-cal higher than those for the unreduced surface. Chemisorption of O and strong CO-metal interaction prevented the evaluation of the reduced-metal thermodynamic data. The calculated adsorption energy between A and an idealized Mo metal surface agreed with the experimental value. The calculated absolute entropies for the adsorbed phase were compared with the theoretical values obtained from statistical-mechanical considerations. Results indicated that N and A formed immobile adsorbed layers on unreduced Mo and that adsorbed O approached the liquid state. (NRS abst.)

SPECTROSCOPY

5350
Harvard Univ.
PHOTOMETRIC STUDIES OF DERIVATIVES OF TRIPHENYLMETHANE IN LIQUID SULFUR DIOXIDE; TECHNICAL REPORT NO. 6 COVERING PERIOD 1 APRIL 1951–1 SEPTEMBER 1951, by Paul D. Bartlett and Ralph E. Weston, Jr. Apr. 10, 1952. 33p. (NP-3880; Technical Report No. 6; U22300)

Ionic-equilibrium phenomena were investigated in connection with a study of the effects of substituents in free radicals of the triphenylmethyl type. Spectra and absorbancies were measured with a Beckman model DU spectrophotometer modified to include a thermostatted cell holder. The dilution cell permitted the pouring of half the solution from the optical cell into the reservoir and the distillation of pure solvent back into the dilution bulb. The relative concentration error was estimated to be 11% after 5 dilutions. Spectra were obtained for triphenylmethane, triphenylcarbinol, trityl chloride, trityl perchlorate, hexaphenylethane, anthracene, trinitrobenzene, and anthracene-trinitrobenzene (1:1 complex). The dissociation constant for trityl chloride in SO_2 was measured and compared with values obtained by conductivity methods. (NRS abst.)

5351
[Mallinckrodt Chemical Lab., Harvard Univ.]
THE PURE QUADRUPOLE SPECTRA OF SOLID CHLOROACETIC ACIDS AND SUBSTITUTED CHLOROACETIC ACIDS, by Harry C. Allen, Jr. [nd] 10p. (NP-3951; U22745)

The pure quadrupole spectrum of Cl^{35} was measured in $CH_2ClCOOH$ and its derivatives at 77° and 295°K with a f-m superregenerative spectrometer similar to that of Dean and Pound (J. Chem. Phys. 20, 195(1952)). Multiple lines were observed in several compounds; small splittings (<0.5 Mc) were attributed to crystallographically nonequivalent chlorines. The absorption lines of the chemically different chlorines in CCl_3COCl were separated by 7 Mc. Intermolecular H bonding appeared to cause the slightly greater than 1-Mc line separation in $CCl_3CH(OH)_2$. No absorption was observed for CCl_3COOH and CCl_3CONH_2 above −158° and −43°C, respectively. Below −43°C, CCl_3CONH_2 had 3 lines down to −158°C but 6 lines at −196°C. The varied chlorine frequencies in the CCl_3 and CH_2Cl groups indicated that the electron withdrawal ability of the groups increases in the order COO^-, $CONH_2$, COMe, $COCH_2Cl$, COOEt, COOH. (NRS abst.)

5352
l-TYPE DOUBLING TRANSITIONS IN HCN AND DCN. Thomas L. Weatherly and Dudley Williams. Phys. Rev. 87, 517-18(1952) Aug. 1.

Direct transitions between levels split by l-type doubling have been observed for J = 9, 10, and 11 in HCN and for J = 10, 11, and 12 in DCN. The l-type doubling coefficient calculated from the observed line frequencies shows a slight decrease with increasing J for both molecules. While the observed values of the l-type doubling coefficient q are in good agreement with those calculated theoretically, the slight variation of q with J was not expected. This variation of q with increasing J involves a negative term in q proportional to J(J + 1) and may therefore be related to the effects

involved in centrifugal stretching of the rotating molecule. (auth)

SYNTHESES

5353

Columbia Univ.

UTILIZATION OF WASTE FISSION PRODUCTS IN CHEMICAL REACTION, by W. A. Selke, S. Engel, C. Kardys, R. C. Jagel, and E. V. Sherry. Apr. 1, 1952. 7p. (NYO-3328)

The syntheses of ammonia, phenol, and SO_3 through the use of a γ radiation field from a Co^{60} source is reported. In the ammonia synthesis, variables of dosage, glass surface-volume ratio, and reactant ratio were studied. The yield was found to increase markedly with the use of glass wool for extended surface. The use of steel wool also caused increases. In the phenol synthesis, variables of dosage, extended glass surface using ⅛-in. Raschig rings, and feed solutions both of benzene in water and water in benzene were studied. The rate of formation of phenol was found to drop off after 3 hr of batch irradiation, with up to 9% yield being effected in 48 hr. Increased surface had no appreciable effect, and benzene saturated with water produced no noticeable phenol product. Conversion to diphenyl also was noted, and H_2 gas was given off. SO_3-synthesis apparatus is being constructed and tested. (auth)

5354

BIOSYNTHESIS OF RADIOACTIVE PYRETHRINS USING $C^{14}O_2$. John P. Pellegrini, Jr., A. C. Miller, and R. V. Sharpless. J. Econ. Entomol. 45, 532-6(1952) June.

A method is described for the biosynthesis of C^{14}-labeled pyrethrins. Chrysanthemum cinerariaefolium plants were exposed to $C^{14}O_2$ atmosphere for 46 days before harvesting of the mature flowers. Extraction and purification techniques yielded highly refined randomly-labeled pyrethrins of specific activity sufficiently high for tracer studies.

TRACER APPLICATIONS

5355

Brookhaven National Lab.

STUDIES IN THE MECHANISM OF THE WILLGERODT REACTION. III. NATURE OF THE LABILE INTERMEDIATE, by Edward Cerwonka, R. Christian Anderson, and Ellis V. Brown. Brookhaven National Lab. and Fordham Univ. [nd] 15p. (BNL-1212)

The nature of the labile intermediate participating in the Willgerodt reaction with phenyl n-butyl ketone has been investigated using D as a tracer. δ-Phenylvaleramide, the reaction product from this ketone, was found to have retained only 5% of the D which had originally replaced H on the β carbon of the alkyl side chain. This evidence is interpreted as indicating that an unsaturated intermediate, possibly acetylenic in nature, had been formed during the course of the Willgerodt reaction. (auth)

5356

Brookhaven National Lab.

THE CHARGE TRANSFER REACTION BETWEEN MOLYBDO- AND MOLYBDIOCTACYANIDES, by Richard L. Wolfgang. [nd] 5p. (BNL-1213)

A Mo^{99}-tracer method is outlined and results are given for the charge transfer between $K_4Mo(CN)_8$ and $K_3Mo(CN)_8$ which indicate the validity of Libby's proposal (Symposium on Electron Transfer and Isotopic Reactions, J. Phys. Chem. (in press)) that the Frank-Condon principle is of primary importance in determining the rates of redox reactions in solution. The exchange in aqueous solution is extremely rapid.

5357

GENERAL SCIENCES. Pt. XIII of THE RADIOISOTOPE. AEC Isotopes Div. Charles E. Crompton, tech. adviser. 1952. 16 mm film (PMF 5147c). B & W, sound, running time: 46 min. (cf. NSA 6-2840)

The radioisotope is shown to be a research tool which is adaptable to tracer investigations in all branches of general science. Eight experiments shown in the order of increasing complexity illustrate how radioisotopes can be used in metallurgy, chemistry, biochemistry, and plant physiology. The methodology of tracer research is observed. New techniques, such as isotope dilution and two-dimensional paper chromatography, are introduced. The experiments include (1) self-diffusion of solid Cu, (2) vapor pressure over metallic Ag, (3) exchange of chloride ions in solid and liquid, (4) exchange of Na and K through cell wall, (5) rearrangement of atoms within a molecule—Wolff rearrangement of a diazo-ketone, (6) metabolism of cholesterol from Na acetate in liver, (7) fate of C atoms during metabolism of glycine in blood, and (8) the chemical path of C during photosynthesis in algae.

URANIUM AND URANIUM COMPOUNDS

5358

Mallinckrodt Chemical Works

MANUFACTURE OF URANIUM AT THE BOUCHET PLANT OF THE FRENCH ATOMIC ENERGY COMMISSION, by C. Eichner, B. Goldschmidt, and P. Vertes. Translated by G. W. Lewis, Jr., from Bull. soc. chim. France, 140-2 (1951). Issued June 4, 1952. 15p. (NYO-1340)

The French-language original of this translation appeared in Bull. soc. chim. France, 140-2(1951) and was abstracted in Nuclear Science Abstracts as NSA 5-6218.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

5359

Consolidated Vultee Aircraft Corp.

NOTES ON THE FLUID DYNAMIC AND HEAT TRANSFER ASPECTS OF REACTOR DESIGN, by W. A. Spraker. Sept. 24, 1951. 20p. (FZA-X6-501; ATI-154974)

Variables that must be considered in the fluid-dynamic and heat-transfer aspects of reactor design are discussed. Calculations are included of factors that affect the perverse-reactor characteristics, relations between heat-transfer area and flow area, effects of longitudinal power distribution, temperature distribution within the fuel element, and air-cycle reactor design procedure.

5360

Lewis Flight Propulsion Lab., NACA

MATRIX AND RELAXATION SOLUTIONS THAT DETERMINE SUBSONIC THROUGH FLOW IN AN AXIAL-FLOW GAS TURBINE, by Chung-Hua Wu. July 1952. 65p. (NACA-TN-2750)

A method recently developed for determining the steady flow of a nonviscous compressible fluid along a relative stream surface between adjacent blades in a turbomachine was applied to investigate subsonic through flow in a single-stage axial-flow gas turbine. For both incompressible and compressible flows, the variation in flow on the stream surface was determined by using both the relaxation and the matrix methods. In all solutions considered, convergence was obtained without difficulty. The compressibility of the gas and the radial twist of the stream surface had equally significant effects on the considerable amount of radial flow obtained. The results of these accurate calculations provide a basis for evaluation of simpler, more approximate methods for computing subsonic through flow in turbomachines. (NACA abst.)

5361
Massachusetts Inst. of Tech.
METEOR; THE MECHANICS AND THERMODYNAMICS OF STEADY ONE-DIMENSIONAL GAS FLOW WITH TABLES FOR NUMERICAL SOLUTIONS, by A. H. Shapiro, W. R. Hawthorne, and G. M. Edelman. Dec. 1, 1947. 81p. (NP-3942)

A one-dimensional analysis for flow without shocks is presented. This analysis takes into account the simultaneous effects of area change, wall friction, drag of internal bodies, external heat exchange, chemical reaction, change of phase, injection of gases, and changes in molecular weight and specific heat.

5362
HEAT TRANSPORT IN LEAD-BISMUTH ALLOYS. J. L. Olsen. Proc. Phys. Soc. (London) A65, 518-32(1952) July 1.

The variation with temperature and with magnetic field of the heat conductivity of a series of Pb-Bi alloys has been measured. As the concentration of Bi is increased the heat conductivity in the normal state falls below that in the superconducting state, contrary to the case in pure superconductors. Estimates have been made from the experimental data of the processes contributing to the heat conductivity, and of the resistances due to the various scattering mechanisms limiting these conductivities. (auth)

MATERIALS TESTING

5363
Oak Ridge National Lab.
STRESS-STRAIN-TIME PHENOMENA IN MECHANICAL TESTING. A STUDY OF THE STRESS-STRAIN-TIME FUNCTIONS OF METALS IN SIMPLE MONOTONIC TENSION, by A. G. H. Andersen. Issued May 26, 1952. 104p. (ORNL-1114)

The development of mathematical expressions for stress as functions of strain, time, and constant and variable strain rates is given. Experiments on copper at 22°C were performed and the results are in agreement with the derived equations.

PUMPS

5364
Argonne National Lab.
DIRECT CURRENT ELECTROMAGNETIC PUMPS, by A. H. Barnes, F. A. Smith, and G. K. Whitham. Oct. 25, 1949. Decl. July 29, 1952. 37p. (AECD-3430; ANL-4322)

A number of d-c conduction-type electromagnetic pumps for liquid metals were constructed. Pumping capacities of over 400 g/min and efficiencies of over 50% were obtained. NaK alloy at temperatures up to 400°C was used in the tests. The large currents required were obtained from rectifiers or from a homopolar generator constructed for the purpose. (auth)

5365
Argonne National Lab.
ELECTROMAGNETIC PUMP FOR LIQUID METALS, by A. H. Barnes, F. A. Smith, and G. K. Whitham. July 15, 1949. Decl. July 29, 1952. 20p. (AECD-3431; ANL-4317)

A description is given of the construction and performance of an a-c linear-induction electromagnetic pump for liquid metals. The effect of varying both the input-current frequency and the number of poles of the winding was investigated. Capacities of over 100 g/min at efficiencies of 10 to 15% were obtained. A six-pole winding operating at 50 to 60 cps was found to give optimum output and efficiency. (auth)

5366
Knolls Atomic Power Lab.
MECHANICAL LIQUID METAL PUMPS IN THE ALPLAUS (GENIE) HEAT TRANSFER SYSTEM, by P. M. Clark. Nov. 1, 1951. 31p. (KAPL-635)

The design and operation of the mechanical liquid metal pumps in the Alplaus (Genie) heat-transfer system are described. The pumps are centrifugal pumps with long overhung rotors. The pumping elements are contained in drain tanks which return pump leakage to the storage tanks. The drain tanks, which are pressurized with an inert gas, are sealed at the pump shaft with a face-type rotary shaft seal. The development of the seal is described. The highest liquid-metal operating temperature at the pump has been 800°F.

MINERALOGY, METALLURGY, AND CERAMICS

5367
Ames Lab.
MECHANICAL CHARACTERISTICS OF SLURRIES, by Glenn Murphy, Warren I. Mitchell and Donald F. Young. June 25, 1952. 71p. (ISC-237)

This compilation consists of a list of references on the mechanical characteristics of solid-fluid mixtures contained in a number of bibliographical sources for the period 1930 to 1951. A brief abstract of each reference is presented.

5368
Richards Mineral Engineering Lab., Mass. Inst. of Tech.
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS; PROGRESS REPORT. July 31, 1952. 22p. (NYO-3670; MITS-16)

Adsorption studies with C^{14}-labeled dodecylamine acetate have been continued. Contact-angle measurements on sphalerite have been made over the concentration range 0.10 to 50 mg of amine salt per liter. The reversibility of the process of adsorption of dodecylamine on hematite has been studied. A study of the distribution of hexyl mercaptan between the gas, water solution, and mineral phases has continued. The gas and water-solution distribution is studied to find if Henry's law is applicable over a wide range of concentration of mercaptan in the liquid phase at a neutral pH. Zeta-potential measurements on quartz in flotation systems are described. The behavior of complex metal anions with anion exchange resins is discussed. Electron-microscopic research on fine particle sizing has continued with the investigation of some of the properties of cellulose acetate screens. The solid-state diffusion of Na in the feldspar system is discussed.

CERAMICS AND REFRACTORIES

5369
Lexington Project
SOME SPECIAL REFRACTORY MATERIALS, by F. H. Norton. Sept. 28, 1948. Decl. July 7, 1952. 30p. (AECD-3424; LP-174)

The chemical and physical properties of various refractory materials are discussed and tabulated.

GEOLOGY AND MINERALOGY

5370
LOCATING BURIED RADIOACTIVE SOURCES. Richard I. Condit and J. D. Graves. Nucleonics 10, No. 6, 18-21(1952) June.

How to design an efficient search procedure is described. The elevation at which radiation intensity is the highest, at a given surface distance away from a buried radioactive source, is calculated. The radiation intensity as a function

of elevation and surface distance is given for depths of 15 and 30 cm. Design of the optimum search procedure is described. Choice of the right source-to-detector elevation can reduce search time and effort by as much as one-third.

5371
DETERMINATION OF GEOLOGIC TIME. Richard L. Burling. Nucleonics 10, No. 5, 30-5(1952) May.

Radioactivity methods for calculating geologic ages are reviewed. The first method described is for a single isolated system in which a nuclide A decays by alternative processes, forming B as one of its daughters. A(i) and B(i) are the initial atomic abundances of A and B, respectively. Four cases are considered: B(i) unknown, B(i) = 0, A(i) known, and B(i) known and not 0. The second method discussed is for an isolated system containing a nuclide A which decays to form B, which is stable. The parent and daughter are considered to have stable isotopes A′ and B′, respectively, and the system is separated at an initial instant into two phases. "Corrected" ages are determined by regarding the specimen as phase 2, the rest of the earth's crust as phase 1, and the sample so much richer in A than is the rest of the earth's crust, that $A_1 \ll A_2$. If a mineral contains essentially none of A but appreciable amounts of B, the isotopic composition of the daughter in the mineral may be regarded as being that of the material from which the mineral was separated. A final method is described in which artificial radioelements of known decay constants are used. The two phases could have been separated from each other at a time before all the A had decayed. Thus the isotopic compositions of the daughter could differ in the two phases.

5372
INTERPRETATION OF RADIOACTIVITY LOGS IN REEF LIMESTONE. Robert E. Bush. Texas J. Sci. 4, 113-21 (1952) Mar. 30.

The qualitative interpretation of radioactivity logs in the reef limestones of West Texas has been discussed briefly, and the basis of quantitative interpretation of radioactivity logs has been discussed and illustrated by examples from the Kelly field in Scurry County, Texas. The method of determining porosity by establishing the relation between the neutron deflection from a reference point and the corresponding core porosity has been discussed. By application of the neutron derived porosity curve or a neutron derived porosity scale, it is possible to determine average porosities in the reef limestones in this field and in other reef limestone fields. (auth)

5373
ASSOCIATION OF RUBIDIUM AND POTASSIUM AND THEIR ABUNDANCE IN COMMON IGNEOUS ROCKS AND METEORITES. L. H. Ahrens, W. H. Pinson and Margaret M. Kearns. Geochim. et Cosmochim. Acta 2, 229-42(1952). (In English)

Spectrochemical determinations of Rb and K in common igneous rock types (granite, diabase, basalt, gabbro, and ultramafics) and in chondrites are given. These determinations show that the ratio K/Rb remains virtually unchanged when proceeding from rock type to rock type, and in crustal igneous rocks %K/%Rb is 90 on the average. In chondrites this ratio remains remarkably uniform (av. 100) and to within an assumed tolerance of ±20% is equal to that in terrestrial igneous rocks. As neither K nor Rb enters metal and sulfide phases to a significant extent, it is concluded that to within ±20% the ratio K/Rb in the earth as a whole is equal to that in meteoritic matter as a whole: it is believed that this is the first recorded example of such a relation. The abundance of K in chondrites is relatively uniform and appears to be considerably less than that usually given in the literature. The present determination shows that for the ultramafic rocks (mainly dunite and serpentine) the estimated abundance of K has to be drastically reduced. As a result, heat production by K^{40} in a dunite mantle may be a small fraction, perhaps only 1/30, of that contributed by the U + Th series. The abundance of Rb is 0·035% in crustal igneous rocks and 0·0009% in chondrites. (auth)

METALS AND METALLURGY

5374
North American Aviation, Inc.
THE EFFECT OF THE RATE OF COOLING ON THE ALLOTROPIC TRANSFORMATION TEMPERATURES OF URANIUM, by Pol Duwez. Issued Feb. 18, 1952. Decl. July 17, 1952. 19p. (AECD-3421; NAA-SR-169)

Allotropic transformation in uranium has been studied over a range of cooling rates from 5° to about 8000°C/sec. The transformation temperatures of both gamma-to-beta and beta-to-alpha were found to decrease continuously with increasing rates of cooling. The extent of the beta range increased with increasing cooling rate. For rates of cooling up to 1000°C/sec, recalescence was observed in both transformations. For higher cooling rates, there was usually no recalescence. In most of the recorded cooling curves, a small but definite thermal arrest was observed, between the two main arrests which correspond to the two known phase transformations. This additional thermal arrest was also present in a heating curve, where it occurred at about 740°C, compared with 666° and 771°C for the two known phase transformations. Possible explanations of the additional arrest are discussed. (auth)

5375
Westinghouse Atomic Power Div.
THE DETERMINATION OF SOLID SOLUBILITIES BY A STRAIN-AGING TECHNIQUE, by G. R. Speich and S. A. Kulin. June 12, 1952. Decl. Aug. 4, 1952. 15p. (AECD-3425; WAPD-T-12)

A strain-aging technique has been used to determine the solid solubility of Sn in Zr at comparatively low temperatures. This method may be applied to the determination of solid solubilities at low temperatures in other alloy systems. An optimum temperature range exists over which this method is applicable. This is a function of the alloy being investigated and must be determined experimentally in each case. (auth)

5376
Knolls Atomic Power Lab.
SAMPLING OF HIGH TEMPERATURE ALKALI METALS, by W. H. Bruggeman and G. Billuris. [nd] 16p. (AECU-2143)

The development history of sampling procedures used for determining the O content of Na and other alkali metals is presented. The KAPL sampling device, which is adaptable to a variety of sampling applications, is described in detail. (auth)

5377
Battelle Memorial Inst.
SURFACE PREPARATION OF ZIRCONIUM FOR BRAZING, by W. C. Schickner, J. G. Beach, and C. L. Faust. July 1, 1952. 7p. (BMI-758)

A method for applying a replacement Zn film on Zr and Zr alloy surfaces is described. Zn-coated Zr or Zr alloy can be soft soldered and silver soldered using conventional techniques. (auth)

5378
Brookhaven National Lab.
NEUTRON DIFFRACTION STUDIES OF COLD WORKED BRASS, by R. J. Weiss, J. R. Clark, L. Corliss, and J. Hastings. Brookhaven National Lab. and Watertown Arsenal and Naval Post Graduate School, Monterey, Calif. [nd] 14p. (BNL-1211)

Neutron powder-diffraction data have shown the integrated intensities to be identical in cold-worked and annealed brass

with no trace of extinction effects. Long-wavelength transmission studies have also shown that the diffuse scattering is increased by less than 0.4% upon severely cold-working brass. A new technique of examining the Bragg discontinuities supports the hypothesis that the major part of the broadening is due to lattice distortion. Some remarks are presented concerning the analogy between long-wavelength neutrons and conduction electrons with respect to scattering by dislocations. The effects of dislocations on coherent scattering also are considered. (auth)

5379

Armour Research Foundation

PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS; THE ZIRCONIUM-OXYGEN SYSTEM [COVERING PERIOD] APRIL 1–JUNE 30, 1952, by Robert F. Domagala and Donald J. McPherson. June 30, 1952. 14p. (COO-98; Report No. 1)

The determination of the phase relationships in the O-Zr binary system up to 50 at. % O is reported. Experimental techniques for the preparation of the alloys and their annealing are discussed. The results of preliminary experiments are presented.

5380

Ames Lab.

THE RESISTIVITY OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM AT LOW TEMPERATURES, by N. R. James, S. Legvold, and F. H. Spedding. Aug. 8, 1952. 22p. (ISC-249)

The electrical resistivities of La, Ce, Pr, and Nd metals from room temperature to 2.2°K are presented. The hcp modification of La is found to possess a higher resistivity than fcc. The mean of the observed superconducting transition temperatures for La is 5.8°K. Anomalies in the resistivity of Ce which occur at liquid-N_2 temperatures and between 11 and 14°K are discussed in connection with the crystal structure. An anomaly in the resistivity of Nd occurs at approximately 12°K. (auth)

5381

Michigan Univ.

INFLUENCE OF CHEMICAL COMPOSITION ON RUPTURE TEST PROPERTIES AT 1500°F OF FORGED CHROMIUM-COBALT-NICKEL-IRON BASE ALLOYS, by J. W. Freeman, J. F. Ewing, and A. E. White. July 1952. 69p. (NACA-TN-2745)

Sixty-two alloys involving systematic individual variations of 10 elements present in a forged chromium-cobalt-nickel-iron base alloy in the solution-treated and aged condition and simultaneous variation of Mo, W, and Nb were rupture tested at 1500°F. It was found that the elements can be varied individually between quite wide limits without significantly changing the rupture properties. The results were similar to those previously obtained at 1200°F (NACA Rept. 1058) except that increased Cr was not beneficial at 1500°F, and the saturation effect for Mo and W did not occur at 1200°F.

5382

Carnegie Inst. of Tech.

PREVIEW OF BEHAVIOR OF GRAIN BOUNDARIES IN CREEP OF ALUMINUM BICRYSTALS, by F. N. Rhines and A. W. Cochardt. July 1952. 40p. (NACA-TN-2746)

Gliding of Al bicrystals along their mutual boundary was studied during creep tests at 200 to 650°C and 1 to 100 psi. The direction of motion depends only on the direction of maximum resolved shear stress in the boundary plane. The magnitude of the motion increases with magnitude of resolved shear stress, temperature, and degree of mismatch between orientations of the crystals. Gliding rate is cyclic and for each temperature there is a stress below which gliding does not occur. At low temperature and small orientation difference an induction period precedes gliding. Gliding operates in a relatively thick zone of crystalline metal on both sides of the boundary. Portions of the grains away from the boundary degenerate into blocks that move with respect to each other, parallel to the tension axis, and that rotate about octahedral axes of the original crystal. (NACA abst.)

5383

Armour Research Foundation

BRAZING AND SOLDERING OF TITANIUM AND ITS ALLOYS; INTERIM TECHNICAL REPORT NO. 1, SEPTEMBER 1, 1951–JANUARY 31, 1952, by N. A. DeCecco, Robert R. Banks and John M. Parks. [nd] 27p. (NP-3888; Interim Technical Report No. 1; U22418)

Metal-halide fluxes were evaluated for use in the preparation of Ti surfaces for brazing. Ag, Cu, Mn, and Sn chloride fluxes, individually, proved satisfactory; thin metallic films were deposited electrochemically on the Ti surface during induction brazing in an He atmosphere. Ag and Mn chlorides, each mixed with KCl, performed the same function for brazing in air with an oxyacetylene torch. A satisfactory bond was obtained when soft solder (40% Pb-60% Sn alloy) was used in soldering a Ti surface which was electrochemically coated with Ag, Cu, or Sn; no quantitative evaluation of these joints was made. Ag- and Ag solder A-brazed joints were produced in inert atmospheres with Cu and Ag chlorides; the Cu caused heavy erosion of the Ti. The joints exhibited good fillets and physical appearance; the brazing metals evidenced good wettability and joint coverage. Commercial flux B was also satisfactory for brazing Ti. Ag, flowed on Ti, adhered better during bend testing than Ag solder A; the difference was attributed to alloy additions in the solder which caused the formation of different intermetallic compounds. (NRS abst.)

5384

Armour Research Foundation

DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 1, OCTOBER 1, 1951 - JANUARY 31, 1952, by W. Rostoker. [nd] 32p. (NP-3929; U22548; Interim Technical Report No. 1)

Several Ti-Cr-Mo alloys lying along the 60%-Ti section of the phase diagram were examined after homogenization at 1000°C. X-ray patterns failed to show the presence of ternary phases. The lattice parameters of α and γ showed no significant change in most of the alloys lying in two- or three-phase fields. Isothermal sections were constructed for six temperature levels between 550 and 850°C. The 800 and 850°C sections were determined metallographically; sections below 800°C were established from x-ray data. The accuracy of the final phase boundaries appears to be ±1.0 wt %. From 550 to 650°C, the contour of the $\beta/\alpha + \beta$ boundary changed from convex to concave with decreasing temperature. In the Ti-Mn-Mo system, Mo segregation and loss of Mn indicated that the alloy composition desired can be obtained only in the low-Mo range of the system. Ingots obtained from arc-melting Ti-Mn-Al alloys showed weight losses almost linearly proportional to the nominal Mn content of the alloy. (NRS abst.)

5385

Watertown Arsenal

METALLURGICAL ADVISORY COMMITTEE ON TITANIUM; SUMMARY OF ROUND TABLE MEETING ON SURFACE TREATMENT OF TITANIUM HELD AT WATERTOWN ARSENAL [ON] MAY 20, 1952. May 20, 1952. 18p. (NP-3991)

Summaries are given of talks presented during this conference on the surface treatment of Ti. Topics discussed included carburizing and induction hardening, nitriding, surface hardening with metalloid elements, siliconizing, vapor-deposited coatings, chemical surface treatment, and

electroplating on Ti. Wear and friction studies on Ti were reviewed.

5386
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 7, SCOPE III, by B. L. Averbach, M. Cohen, S. Allen and P. Fopiano. June 30, 1952. 3p. (NYO-862; Technical Progress Report No. 7)

Plastic deformation of Cu-Si single crystals was studied and atomic displacements determined as a function of the deformation. The effective particle size was also determined. Progress is reported in the study of deformation of pure Cu and pure Al single crystals.

5387
Royal Aircraft Establishment, Farnborough, Hants (England)
REVIEW OF THE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS, by J. T. Ballett. Jan. 1952. 72p. (RAE TN-MET-155)

The properties of Ti are reviewed with special reference to the effect of O, N, H, and C which are common impurities. A survey is made of the published data on experimental Ti-base alloys, and of the properties of commercial alloys so far developed in America. The mechanical properties of Ti and its alloys are compared with some other structural materials over the range room temperature to 500°C (932°F). A summary of manipulation properties is also given. The possible uses in aircraft structures, propulsion units, and various other applications are discussed, and the present cost and availability of material is reviewed. (auth)

5388
Sylvania Electric Products, Inc.
SELF-DIFFUSION OF METALS AND ASSOCIATED PHENOMENA (VII); PROGRESS REPORT FOR OCTOBER 1, 1951 TO APRIL 1, 1952, by R. W. Balluffi, H. P. Kling, F. D. Rosi and L. Seigle. Issued June 23, 1952. 15p. (SEP-100)

Investigations of the formation of porosity by diffusion in α-brass single crystals have been completed. These revealed the same amount of porosity in single-crystal as in polycrystalline material. The relationship between porosity formation and presence of grain boundaries is being further studied using bi- and tri-crystals of α-brass. Relative diffusivities in β-brass are being measured by diffusion of Zn from the vapor phase. Experimental work has been completed for the Au-Ag and Ni-Cu systems, and relative diffusivities are being determined by graphical analysis of the diffusion curves. The kinetics of sintering of silver powders is being studied by optical dilatometry. Kinetics and orientation relationships for secondary recrystallization, exaggerated grain growth, and controlled recrystallization in pure Al are being investigated in order to compare the mechanisms of these processes. Preliminary work on a study of the recrystallization of single crystals is under way. Studies of the plastic properties of Ag, Cu, and Cu-Al alloys are being continued. Considerable progress has been made in correlating the nature of the slip markings with the shape of the stress-strain diagrams for these and other metals. Work is progressing in the accumulation of creep data for pure Ag over a wide range of stress and temperature. (auth)

5389
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; FOURTEENTH QUARTERLY REPORT, PROGRESS REPORT NO. 31, by J. Hollomon and D. Turnbull. July 5, 1952. 7p. (SO-2022; RL-713; Progress Report No. 31)

Preliminary results have been obtained on the rate of self-diffusion of Ag at a single grain boundary. These results are in good agreement with earlier results obtained on polycrystalline aggregates. An effect of crystallite size on the magnitude of the heat capacity of graphite above 100°K has been found. The heat capacity of hexagonal selenium between 16 and 300°K has been measured and interpreted. In a preliminary experiment, thermal diffusion (Soret effect) was observed in a copper-gold alloy with a temperature gradient of 1200°C/cm.

5390
METALS MELTED WITHOUT CRUCIBLES. E. K. Okress and D. N. Wroughton. Iron Age 170, No. 5, 83-6(1952) July 31.

A block to production of pure high-melting metals is that while impurities boil off during melting, others are picked up from any known crucible material. One solution is to melt such metals in space. Heating, stirring, and support are provided by magnetic fields from coils surrounding the melt. Alloying is simple. The process shows great promise in sintering applications. (auth)

5391
THE DIFFRACTION OF X-RAYS BY LIQUID ALLOYS OF SODIUM AND POTASSIUM. N. S. Gingrich and R. E. Henderson. J. Chem. Phys. 20, 1117-20(1952) July.

Monochromatic x-ray diffraction patterns were taken of liquid alloys of sodium and potassium of seven different compositions at 115°C. Contrary to previous results, the present work does not show in a plot of position of main peak vs. composition an inflection which had been taken as evidence for the existence of Na_2K molecules in the liquid. Fourier analyses made for five of the alloys gave distribution curves which prove that there are no compact molecules in these liquid alloys, though they do not rule out the possibility that there may be weakly associated groups of atoms. (auth)

5392
THEORY OF GRAIN BOUNDARY DIFFUSION. R. Smoluchowski. Phys. Rev. 87, 482-7(1952) Aug. 1. (cf. NSA 5-3147)

The previously proposed dependence of the structure of grain boundaries upon the angle of disorientation of the two grains is used as a basis of a quantitative consideration of diffusion along grain boundaries and in particular of the apparent activation energies. At small angles in the dislocation range the diffusion is controlled by volume diffusion mechanism. At high angles near 45° the model of a uniform grain boundary is applicable. In the intermediate range an array of rod-like areas of distorted lattice leads to low or even negative apparent activation energies. The theory is in good agreement with experiment. (auth)

5393
EXTINCTION EFFECTS IN POWDERS. R. J. Weiss. Proc. Phys. Soc. (London) B65, 553-5(1952) July 1.

In order to explain reported differences (Hall and Williamson, Proc. Phys. Soc. (London) B64, 937(1951)) in the integrated intensities of the Debye-Scherrer rings for cold-worked and annealed metals, an attempt is made to clarify the effects of extinction in powders. It is concluded that on the basis of available data no distinction can be made between primary and secondary extinction. It is felt, however, that the two types could be distinguished by varying the size of the imperfect single crystal.

5394
CHANGES IN ELECTRICAL CONDUCTIVITY OF METALS AT FUSION. Geneviève Sutra. Compt. rend. 234, 2589-91 (1952) June 30. (In French)

By comparing the changes in electrical conductivity with the changes in volume on fusion of Bi, Ga, Sb, Li, K, Sn, Pb, Hg, Cu, Zn, Au, and Al, the author shows that the two changes are functionally related. The numerical values used have been critically evaluated.

PHYSICS

5395

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 250p. (AECU-2128)

Separate abstracts have been prepared for the following sections of this report: Chemistry of the Fission Elements Group, p.1-14; Cosmic Ray Group, p.15-42; Elementary Particle Scattering Group and M.I.T.-O.N.R. Generator Construction and High Voltage Research Group, p.43-102; Nuclear Chemistry (Inorganic) Group and Nuclear Chemistry (Organic) Group, p.103-52; ONR Generator Group and Radioactivity and Cyclotron Group, p.153-207; and Synchrotron Group and Theoretical Group, p.208-22.

5396

Ames Lab.

QUARTERLY SUMMARY RESEARCH REPORT IN PHYSICS FOR JANUARY, FEBRUARY AND MARCH 1952. June 20, 1952. 23p. (ISC-246)

The reports on theoretical and experimental physics consist of brief statements on the status of current projects and include no data. The solid-state-physics report gives some experimental results on the following: thermal conductivity and Hall coefficient of Th, electron diffraction of Th surfaces, and resistivity of Gd.

5397

Metals Research Lab., Carnegie Inst. of Tech.

ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS; QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING JUNE 15, 1952, by Robert F. Mehl and Gerhard Derge. July 28, 1952. 13p. (NYO-3690)

Measurement of the electrical conductivity of a molten 50 wt % Cu_2S-FeS matte covering a temperature range from the liquidus (~990°C) to 1180°C confirmed the linear increase of specific conductance with temperature found in previous work. However, new data taken from 1180 to 1300°C show that electrical conductance are essentially independent of temperature in this range, suggesting semiconductance in the liquid state. Measurement of current efficiency in liquid FeO in an Fe crucible indicates a negligible transport of ions and confirms the interpretation of conductivity data, showing that the conduction is electronic. Studies of compositions of VCl_2 dissolved in molten LiCl-KCl eutectic (m.p. 355°C) at ~500°C showed that the decomposition potential, 0.39 v, is not strongly dependent on concentration in accordance with the prediction of Nernst's equation.

5398

Oak Ridge National Lab.

PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 50p. (ORNL-1278)

Separate abstracts have been prepared for the following sections of this report: High-Voltage Physics and Radioactivity and Nuclear Isomerism Groups, p.2-12; and Neutron Diffraction, Heavy-Ion Physics, Theoretical Physics, and Instrumentation Groups, p. 12-38.

5399

Oak Ridge National Lab.

NEUTRON DIFFRACTION, HEAVY-ION PHYSICS, THEORETICAL PHYSICS, AND INSTRUMENTATION GROUPS, p.12-38 of PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 27p. (ORNL-1278 (p.12-38))

Results are reported of measurements of the neutron scattering cross sections of Ce, La, Pr, and Nd, using the oxides of the rare earths in their normal isotopic constitution, oxides of Ce enriched in Ce^{140} and Ce^{142}, and oxides of Nd enriched in Nd^{143}, Nd^{144}, and Nd^{146}. The extrapolated ionization ranges of the heavy ions H^+, He^+, N^+, Ne^+, N_2^+, and A^+ have been measured in the gases He, N_2, A, and air at energies from 50 to 300 kev. The report of the Theoretical Group consists of statements of the status of work in progress and methods being pursued in investigations of the following topics: angular correlation of nuclear radiations; triplet neutron-neutron force; angular correlation of radiations from deuteron-stripping reactions; inner-bremsstrahlung internal conversion; and a rational one-particle relativistic electron theory. The report of the Instrumentation Group contains a description of the simplified 20-channel pulse-height selector being studied. Work has started on a curve analyzer that will automatically separate the components of a spectrum observed with a scintillation spectrometer. Tests of neutron-sensitive phosphors, optics of polished scintillation phosphors, and variables affecting performance of 5819 photomultipliers are discussed. A brief description is given of the progress of heavy-ion production and detection.

5400

THE THERMAL CONDUCTIVITY OF LIQUID HELIUM I. R. Bowers. Proc. Phys. Soc. (London) A65, 511-18(1952) July 1.

The thermal conductivity of liquid helium has been measured between 2.2 and 4°K. It is found to increase with temperature over the whole range and shows no sign of anomalous behavior just above the λ-point. This variation is compared with that of the viscosity and entropy in the same temperature range. (auth)

5401

ON THE RELATIONSHIPS BETWEEN THE LANDAU AND LONDON-TISZA MODELS OF LIQUID HELIUM II. H. N. V. Temperley. Proc. Phys. Soc. (London) A65, 490-511(1952) July 1.

The Landau picture of liquid He II as a modified Debye model is critically compared with the London-Tisza picture of liquid He II as a condensed Bose-Einstein assembly in an attempt to find some common features. Two such common features are found, first that the criterion for Bose-Einstein condensation in a one-particle model is $(\partial S/\partial N)_{E,V} \leq 0$ or $g = (\partial F/\partial N)_{V,T} \geq 0$, a condition that can also be satisfied by the Debye model below a certain temperature. Secondly, an assembly satisfying such a condition is, in principle, capable of being in thermodynamic equilibrium with a weakly adsorbed film or with free atoms of small energy. It is also suggested that such atoms may make possible the observed phenomena of superfluid flow because their wave functions are abnormally sensitive to small applied external fields of force, and some evidence in support of this is presented. A numerical study of the Landau-Debye model shows that, in accordance with observed facts on He II, its energy spectrum is probably modified considerably in channels of less than 10^{-4} cm width. It is also concluded that the Debye model is probably not a workable approximation near the λ-point, but that it is correct at sufficiently low temperatures. (auth)

5402

THE DIFFUSION OF THORON IN SOLIDS. PART 3. DIFFUSION AND RECOIL IN MULTIMOLECULAR FILMS OF BARIUM STEARATE BY EMANATING POWER MEASUREMENTS. J. N. Gregory, J. F. Hill, and S. Moorbath. Trans. Faraday Soc. 48, 643-51(1952) July.

The emanating power of multimolecular films of barium stearate, in which one or two layers contain equilibrium Th^{228}-Ra^{224} has been investigated as a function of temperature and thickness of the layer. The multilayer thickness at which the recoil fraction of the emanating power diminishes to zero is a direct measurement of the recoil range

of Rn^{220} from Ra^{224} in this solid. The range agrees very well with that calculated from atomic stopping powers. A theoretical analysis of the system gives functions which closely fit the experimental results, when the diffusion constants (D_0 and Q) are of the same order as found in the bulk solid in previous work. (auth)

AEROSOLS

5403

Naval Radiological Defense Lab.

REPRESENTATIVE SAMPLING OF DUST PARTICLES IN HIGH VELOCITY AIR STREAMS, by T. C. Goodale, B. M. Carder, and E. C. Evans, III. Issued May 1, 1952. 11p. (USNRDL-343; U22518)

A high-altitude aerosol sampler was developed for use on aircraft in flight. The device maintains air flow into its inlet isokinetic with the flow of the air stream sampled over a wide range of altitudes and air velocities. The air stream proceeds from the sharp-edged inlet, mounted on gimbal rings and vaned to insure alignment, through a rubber tube to the expansion section where the particles are precipitated electrostatically on glass slides, electron-microscope screens, or metallic surfaces. The cleaned air is exhausted through the annular outlet around a choke. The choke setting for isokinetic flow into the inlet does not vary with altitude between 14,000 and 32,000 ft or stream velocity between 125 and 200 mph. Methods for analyzing the collected samples are discussed. (NRS abst.)

COSMIC RADIATION

5404

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

COSMIC RAY GROUP, p.15-42 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 28p. (AECU-2128(p.15-42))

Operation of the multiplate cloud chamber at Echo Lake is described, and results obtained with it concerning the new unstable S and V particles in cosmic rays are discussed. Several cloud-chamber photographs are shown. The balloon experiment which was performed to study the behavior of charged cosmic particles in their traversal of 20 cm of Pb has been completed; the results are consistent with a primary proton intensity of $0.19/cm^2/sec/sterad$. Information obtained on the structure of showers of total energy $\sim 10^{14}$ ev is presented graphically. Diagrams are shown of a double-crystal scintillation counter which responds selectively to several of the components of cosmic rays, and one series of results obtained with Pb absorbers is plotted. An attempt is made to correlate analytically the observed changes in the cosmic-ray intensity at sea level with the existing atmospheric conditions. Studies with the high-pressure cloud chamber of the nuclear absorption of π^- mesons in He are reported.

5405

Brookhaven National Lab.

INTERACTION OF PIONS ORIGINATING IN PENETRATING SHOWERS, by R. L. Cool and O. Piccioni. June 19, 1952. 8p. (BNL-1192)

The total interaction cross section of high-energy pions with C, CH_2, and Pb have been obtained in a study of the secondary particles emitted in the penetrating showers of cosmic radiation at 11,000 ft. The deflection of the secondaries in a magnetized block of iron were used to compute an energy spectrum. The median energy of the spectrum is 920 Mev. The increase in ionization losses as the energy decreases accounts for a maximum observed for particles below the iron. Above 1500 Mev, the data lead to a law $S(E)\,dE \propto E^{-2.35 \pm 0.2}\,dE$. About 80% of the secondaries were pions; the cross sections for negative and positive particles show no significant difference. Muons constitute $13 \pm 3\%$ of the secondaries. The tabulated cross-section values indicate that the scattering cross sections are less at this energy than at 133 Mev (Martin et al., Phys. Rev. 85, 486(1952)). The measured cross section for production of mesons at this high energy is 13.5 ± 6 mb.

5406

THE RATIO OF SOFT AND HARD PARTICLES IN AIR SHOWERS. Kurt Sitte. Phys. Rev. 87, 351-7(1952) July 15.

While the density spectrum of air showers is well established for energies above 10^{13} ev, doubt has recently been cast upon the customary procedure of identifying the energy spectrum of the shower-initiating particles calculated from this density distribution with the primary cosmic-ray spectrum. These two distributions would differ if the mechanism of energy transfer to the electron component itself varied with energy. As a result, one would then expect to find a variation with energy also in the amount and composition of the penetrating component of extensive showers. Previous investigations of penetrating particles in air showers do not extend below 10^{13} ev because of the bias imposed, in the case of low-density showers, by the addition of a shielded tray. An experiment was therefore carried out at Mt. Evans, Colo., altitude 4300 m, and at Echo Lake, Colo., altitude 3260 m, in order to compare the penetrating components of showers in the 10^{13}-ev region and in the 10^{14}-ev region at a similar stage of their cascade development. The relative abundance of penetrating particles was $(2.06 \pm 0.11) \times 10^{-2}$ at Mt. Evans, and, $(1.20 \pm 0.11) \times 10^{-2}$ at Echo Lake, and the fraction of N-particles among the penetrating component was $62 \pm 7\%$ for the lower, and $38 \pm 6\%$ for the higher shower energies. The ratio of μ mesons to electrons was the same for both energy ranges. The results are therefore consistent with the assumption that the development of the large mixed cascades in air is based on the same processes for all energies above 10^{13} ev, demanding only a slight increase in the multiplicity of meson production with increasing primary energy. (auth)

5407

THE SOLUTION OF THE FLUCTUATION PROBLEM IN A FINITE ABSORBER FOR NUCLEON CASCADES. H. Messel and R. B. Potts. Proc. Phys. Soc. (London) A65, 473-80 (1952) July 1.

The complete analytical solution of the fluctuation problem for nucleon cascades developing in a finite absorber is given. Expressions are obtained for the general number distribution function and for the nth moments. (auth)

5408

THE SOLUTION OF THE FLUCTUATION PROBLEM IN NUCLEON CASCADE THEORY: HOMOGENEOUS NUCLEAR MATTER. H. Messel. Proc. Phys. Soc. (London) A65, 465-72(1952) July 1.

Solutions are presented for the general number distribution function in cascade theory and for the kth moments of the distribution. The Jánossy G-equation is solved. The methods of solution developed are applicable to the similar problem in the electron-photon case. (auth)

5409

PROGRESS IN COSMIC RAY PHYSICS. J. G. Wilson, ed. Amsterdam, North Holland Publishing Co., 1952. 557p.

A review of this book appeared in Proc. Phys. Soc. (London) A65, 572(1952) and is reproduced here in part.

The present volume consists of eight separate articles written by different authors on branches of the subject in which they are authorities. The stress is always on the physical results rather than on the experimental methods. The reviews deal with the following topics: high-energy nuclear disintegrations, nature of the primary cosmic

radiation, observations underground, time variations, various types of fundamental particles and possible couplings between them, decay processes of heavy mesons, recent data on geomagnetic effects, and equilibrium of the cosmic-ray beam in the atmosphere. Each section has its own list of references, but there is also a general author index—almost a bibliography of cosmic rays—and a subject index.

5410

[VARIATIONS AND ORIGIN OF COSMIC RADIATION]. A. Dauvillier. Paris, Éditions de la Revue d'Optique Théorique et Instrumentale, 1951. 83p. (In French)

A review of this book appeared in Proc. Phys. Soc. (London) A65, 571(1952) and is reproduced here in part.

In the first chapter there are sections dealing with the periodic and nonperiodic intensity changes. These include the solar and sidereal daily variations, the lunar variation, the seasonal variation, and an account of the intensity changes associated with magnetic storms and solar activity. The second chapter reviews some of the theories and speculations about the origin of the radiation which have been advanced during the past 30 yr or so. These include the annihilation hypothesis of Millikan, the cosmological theories of Lemaître and Milne, and the more recent theories which ascribe the origin of the radiation either to stellar magnetic fields or to weak magnetic fields in interstellar space.

5411

NOTE ON THE DIFFERENTIAL MOMENTUM SPECTRUM OF COSMIC-RAY PROTONS AT SEA LEVEL. Carl M. York. Proc. Phys. Soc. (London) A65, 558-9(1952) July 1.

Attention is called to a misprint in Rossi's article (Revs. Modern Phys. 20, 537(1948)) on the differential momentum spectrum of cosmic protons at sea level. A table is presented which gives a summary of present data available in the low-momentum region of the differential spectrum for protons. Corrections are suggested for the vertical-intensity values of Rochester and Bound (Nature 146, 745(1940)) and Mylroi and Wilson (Proc. Phys. Soc. (London) A64, 404(1951)).

5412

AN ANTICOINCIDENCE EXPERIMENT ON COSMIC RAYS AT A DEPTH OF 50 METRES WATER EQUIVALENT. E. Amaldi, C. Castagnoli, S. Sciuti, and A. Gigli. Proc. Phys. Soc. (London) A65, 556-8(1952) July 1.

In order to explain the cross section for production of pairs of penetrating particles underground, Hayakawa (Proc. Phys. Soc. (London) A65, 215(1952)) suggested the existence of a neutral component of cosmic rays underground and proposed an anticoincidence experiment to test the hypothesis. This experiment has been conducted, and some of the results are reported in the present paper. It is concluded that the experimental results do not agree at all with the theory of Hayakawa, the ratio of charged to neutral κ mesons being 15 to 150 times larger than predicted. It was also found that the cross section for production of pairs of penetrating particles is considerably smaller ($\sim 5 \times 10^{-30}$ cm^2/nucleon) than was thought before.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5413

INFLUENCE OF THE APPARATUS FUNCTION ON CRYSTALLITE SIZE DETERMINATIONS WITH GEIGER COUNTER SPECTROMETERS. F. R. L. Schoening, J. N. van Niekerk, and R. A. W. Haul. Proc. Phys. Soc. (London) B65, 528-35 (1952) July 1.

A brief survey of the various methods used for determining crystallite sizes from x-ray diffraction line broadening is given. It is shown that the diffraction profiles determined experimentally with a Geiger-counter x-ray spectrometer can be represented by functions of the type $y = c/(1 + k^2x^2)^2$. Using these functions a correction curve for instrumental influence on line-breadth measurements is derived by solving the integral equation $B(x) = \int_{-\infty}^{+\infty} b(v)\beta(x-v)dv$ by means of the Fourier transform method. The apparatus function b(x) is determined by using a standard substance. Experiments are described which illustrate the effect of sample preparation, absorption, etc. on measurements of line breadth. (auth)

ELECTRICAL DISCHARGE

5414

HIGH FREQUENCY ELECTRICAL BREAKDOWN OF GASES. W. P. Allis and Sanborn C. Brown. Phys. Rev. 87, 419-24 (1952) Aug. 1.

Previous theoretical treatments of high-frequency electrical breakdown in gases based on the Boltzmann transport equation were applied to specific gases and met with mathematical difficulties when applied to higher pressures. A simpler solution applicable to any gas and to a wide pressure range is presented. Agreement between theory and experiment with H gives confidence that the energy distribution function is correct, and the distribution function is therefore used to compute other quantities of physical interest. (auth)

GASES

5415

DIFFUSION AND EXCITATION TRANSFER OF METASTABLE HELIUM IN NORMAL GASEOUS HELIUM. R. A. Buckingham and A. Dalgarno. Proc. Roy. Soc. (London) A213, 506-19(1952) July 22.

The resonance collision of normal and metastable He atoms has been investigated, and cross sections have been calculated for total elastic scattering, diffusion, and transfer of excitation. The theoretical diffusion coefficient of metastable atoms in normal helium agrees reasonably well with experimental results of Ebbinghaus and Biondi. As a consequence of a potential barrier in the interaction of the atoms at large separations, the transfer cross section shows an unusual variation, being small for low collision energies and reaching a maximum of the order of $10\pi a_0^2$ for collisions of about 0.25 ev energy. Comparison is made with experiments by Reynolds (thesis, University of London, 1952). (auth)

INSTRUMENTS

5416

Los Alamos Scientific Lab.

ON THE USE OF PRINTED CIRCUIT CONDUCTORS IN THE LABORATORY, by Richard J. Watts. [nd] 20p. (AECU-2142; LADC-930)

An investigation was made of the use of printed circuit conductors from the point of view of the "fast" electronic circuits used in the laboratory. The steps involved in a stencil technique combined with paint spraying are outlined. The behavior of the wiring was tested, and a graph was shown of resistance vs. current. Prototype instruments were built and compared with the equivalent conventional instruments.

5417

Chalk River Project (Canada)

PROGRESS REPORT [FOR] FEBRUARY–MAY, 1952; ELECTRONICS BRANCH, by J. Hardwick. [nd] 16p. (PR-P-14-E)

Electronics research is reported on a γ radiation detector for aerial survey or for body content of Ra, techniques for measurement of Rn in breath, measurement of slow neutrons with a scintillation counter, reproducibility of emission measurements on thermionic tubes, slow neutron monitor for NRX effluent, half-life measurements of irradiated sam-

ples with an automatic recording electroscope, a low-background anticoincidence unit for auto-turntable, performance of electromechanical registers, overloading in a-c coupled pulse amplifiers, modifications to radiation survey meter model SU-ID, and leakage and breakdown characteristics of various paper condensers.

5418
Atomic Energy Project, Univ. of Calif., Los Angeles
A NEW EXTERNAL OBJECTIVE APERTURE CENTERING AND INTERCHANGING DEVICE FOR THE RCA EMU ELECTRON MICROSCOPE, by F. W. Bishop and S. B. Elliott. Issued July 25, 1952. 10p. (UCLA-209)

An objective aperture centering and interchanging device for the RCA EMU electron microscope is described. The unit is externally operated and permits the selection of any one of five apertures as well as no aperture, facilitates dark field examination of specimens, and eliminates one of the major annoyances associated with the use of an objective aperture in the electron microscope. (auth)

5419
Atomic Energy Project, Univ. of Calif., Los Angeles
A DEVICE FOR MONITORING THE STABILITY OF THE POWER SUPPLIES OF THE ELECTRON MICROSCOPE, by F. W. Bishop and S. B. Elliott. Issued July 25, 1952. 8p. (UCLA-210)

A permanently installed monitoring unit is described which measures the stability of the several critical power supplies of the electron microscope. It replaces the occasional oscilloscope and instead provides a continuous check of the instrument. It detects instabilities before they are able to affect the quality of the electron micrographs and materially assists in the localization of such difficulties. (auth)

5420
Radiation Lab., Univ. of Calif., Berkeley
INSTRUCTION MANUAL FOR UCRL PORTABLE VAPOR DETECTOR MODEL 1EPS, by C. S. Presenz. May 10, 1952. 15p. (UCRL-1853)

A portable vapor detector has been designed to indicate small concentrations of vapors that provide various degrees of opacity to ultraviolet light. It is specially intended as a safety monitor highly sensitive to Hg vapors, stable regardless of line variations between 100 and 140 v rms and simple to operate.

5421
PRODUCTION TESTING OF MULTIPLIER PHOTOTUBES. R. W. Engstrom, R. G. Stoudenheimer, and A. M. Glover. Nucleonics 10, No. 4, 58-62(1952) Apr.

The more pertinent design and production tests applied in the manufacture of type-5819 tubes are discussed. The tests described include cathode sensitivity, anode sensitivity and gain, dark current and high voltage, signal-to-noise ratio, collection efficiency, and magnetic-field considerations.

ISOTOPES

5422
Oak Ridge National Lab.
ELECTROMAGNETICALLY ENRICHED ISOTOPES INVENTORY, JULY 31, 1952, by C. P. Keim, C. E. Normand, and Boyd Weaver. July 31, 1952. 39p. (ORNL-1355)

The inventory lists isotopes that have been concentrated electromagnetically, with completed information on their enriched abundances, and the element weights and product forms available in milligram quantities to users on Atomic Energy Commission projects and in university and industrial laboratories. (auth)

ISOTOPE SEPARATION

5423
Carbide and Carbon Chemicals Co. (K-25)
EQUILIBRIUM TIME FOR A SQUARE PLANT, by D. W. Burton. Issued June 30, 1952. 139p. (K-925)

The report contains a table of equilibrium times for short square plants. This equilibrium time is defined by the relation, if τ is the equilibrium time,

$$\frac{x(N,\tau)-x(0,\tau)}{x(N,\infty)-x(0,\infty)}=1-\epsilon$$

where ϵ has the values 0.02, 0.01, 0.005. The numerator is the difference between the top-stage concentration and the bottom-stage concentration at time τ. The denominator is the same difference at steady-state. In the appendices the mathematical treatment is shown, and for the simple case of no top or bottom sampling drums, it is also shown that the equilibrium time derived by a linear problem differs slightly from the equilibrium time derived from a more exact equation. Thus the table can be used for the complete range of concentrations. (auth)

MASS SPECTROGRAPHY

5424
Brookhaven National Lab.
ANALYSIS WITH A NEW TYPE MASS SPECTROMETER, by Paul I. Richards, Stephen E. Wiberley and S. A. Goudsmit. [nd] 8p. (BNL-1214)

Application of a magnetic time-of-flight mass spectrometer to qualitative and quantitative analytical problems is discussed.

MATHEMATICS

5425
Los Alamos Scientific Lab.
FLOATING DECIMAL CODING SYSTEM FOR CPC (NO. 4 CONTROL PANELS), by Sidney L. Lida. May 1952. 99p. (LA-1418)

A new development in the field of floating decimal calculations for the IBM Card Programmed Electronic Calculator (Model II) is a three-factor two-operation control panel with automatic calculation of certain transcendental functions. Channel X, as the third factor is called, is capable of delivering the previous result of a calculation, or a number punched in the card, or the number stored in either one of two counter groups, to the electronic calculator. It is then possible to calculate any possible arithmetic combination of A, B, and X. Other operations include transcendental functions, manipulative operations, and other special functions. There are many ways for the machine to make decisions. The most important of these is the ability to read instructions from four different fields of the card under varying conditions. A system of checks and adjustments has been devised in case a calculation violates the range of the floating decimal notation. There are stops which tell an operator when he has inadvertently tried to divide by zero or take the square root of a negative number. This report is specifically designed to be read by an experienced coder as well as by a relative beginner in the card-programmed calculator. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

5426
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ENERGY DEPOSITION BY FAST NEUTRONS IN BONE MARROW, by J. H. Tait. Feb. 1952. 10p. (AERE-T/R-871)

The effect of bone on the deposition of energy by fast neutrons in bone marrow is investigated. A calculation is made to determine whether the bone increases the energy flux of fast neutrons at points adjacent to the bone marrow by scattering the neutrons without degrading their energy. It is found that the effect is small and that for purposes of dosimetry calculations, the bone may be replaced by an equal volume of soft tissue. (auth)

5427

Brookhaven National Lab.

NEUTRON MEASUREMENTS WITH THE BROOKHAVEN CRYSTAL SPECTROMETER, by L. B. Borst and V. L. Sailor. [nd] 31p. (BNL-1203)

A new crystal spectrometer for slow-neutron cross-section measurements is described in detail. Beryllium has been found to be an exceptionally good neutron monochromator, extending the useful range of crystal spectrometers to energies of about 50 ev with good resolution. The characteristics of crystals for use as neutron monochromators are discussed in regard to intensity of the Bragg reflection, resolution, spectral distribution, higher-order contamination, and background. Evidence is presented concerning the precision of energy measurements with the BNL spectrometer. The energies of the lowest resonances in the following elements were found to be: iridium, 0.654 ± 0.003; rhodium, 1.260 ± 0.004; indium, 1.458 ± 0.005; rhenium, 2.16 ± 0.01; gold, 4.93 ± 0.03; and silver, 5.235 ± 0.035 ev. Comparison with similar measurements made with time-of-flight spectrometers shows that the de Broglie equation for computing neutron wave lengths is valid to within about ½%, the precision of present-day experimental observations. (auth)

5428

Mound Lab.

NEUTRON SCINTILLATION COUNTING (INFORMATION REPORT), by R. L. Shipp, Jr. Jan. 14, 1952. 32p. (MLM-687)

Neutron scintillation counting was investigated to develop a neutron detector that would be more efficient and less energy dependent than those now in use. The theory of scintillation detection and problems involved in adapting scintillation detection to neutron scintillation counting are discussed. A comparison of various phosphor types is presented, and the design of a scintillation sample tester is included. A technique is described for obtaining uniform dispersion of ZnS(Ag) phosphor in polystyrene.

5429

Western Reserve Univ. School of Medicine

X-RAY DOSIMETRY STUDIES WITH A SCINTILLATION CRYSTAL PROBE, by J. W. Robson and E. C. Gregg, Jr. Western Reserve Univ. School of Medicine and Case Inst. of Tech. May 1952. 22p. (NYO-1648)

The construction and testing of a crystal dosimeter for the measurement of tissue depth doses of x radiation are described. A ⅜-in cube of anthracene was used as a scintillation detector. The depth-dose distribution in a water phantom, simulating a biological medium, exposed to the x-ray beam from the Case betatron was measured and compared with measurements made with a conventional air-ionization chamber. In both cases the relative dose was measured as the ratio between a movable probe in the water and a fixed probe in the air. The advantages of using an organic crystal having absorption properties very similar to water, and therefore to biological material, in the construction of a dosimeter are discussed.

5430

Radiation Lab., Univ. of Calif., Berkeley

A STABLE MICROWAVE REFERENCE SYSTEM, by R. G. Smits and A. J. Schwemin. June 11, 1952. 23p. (UCRL-1843)

A signal generator system continuously variable from 200 to 400 Mc which is stable to one part in 10^8 is described. The principal component is a new harmonic crystal oscillator with this stability. This oscillator plus commercial equipment compose the system. At the present time, the only way to measure changes of frequency of a few cycles per second in the megacycle frequency range is by comparison with a standard whose stability is known. Commercial oscillators are normally designed for high stability only where precision and accuracy are required such as in a secondary standard. Furthermore, such standards are not available above 100 Mc. Frequently, however, precise knowledge of variations of frequency is of more interest than that of the absolute values. As the result of such a situation, the system described in this report was developed to provide a source of highly stable frequencies in the range 200 to 400 Mc. Although the system could probably have been calibrated to read absolute frequencies to at least ±0.01%, no attempt to do so was made. Instead, effort was concentrated on stability. (auth)

5431

Naval Radiological Defense Lab.

MARK V MODEL I BETA-CONTAMINATION MONITOR, by W. F. Joseph, R. M. Bond, and H. C. Rocklitz. Feb. 20, 1952. 18p. (USNRDL-344)

A portable instrument is described which is capable of measuring localized radioactivity in regions of high general fission-product contamination. A β-sensitive detector which is relatively insensitive to γ is used. The total contamination of a given surface may be determined by the known β-to-γ ratio. The detector is of the gas-flow type, using a mixture of argon and CO_2. It is operated at very high gas gains (10^6 and greater) in the region of limited proportionality. The detector is composed of two sections, one having a thin window for β sensitivity, and both having essentially the same γ sensitivity. Indication is obtained by current metering with a differential vacuum-tube voltmeter which cancels the γ-excited output from the two sections of the detector and indicates the β-excited output from the thin-window section. The inherent capabilities of this detection system and the conditions governing its operation are discussed briefly. The instrument is able to detect β activities as low as 1 or 2 mμc in a 10-mr γ field. In higher γ fields the lowest detectable β activities are correspondingly greater. β activities of from 1 mμc to about 0.3 can be measured, and the detector is practically energy-independent for β rays of energy from 0.075 to at least 4 Mev. (auth)

5432

RADIOSENSITIVITY OF ALKALI-HALIDE CRYSTALS. H. Friedman and C. P. Glover. Nucleonics 10, No. 6, 24-9 (1952) June.

Visible coloration can be induced in the alkali halides by exposure to x rays or γ rays. Electrons ejected from negative halide ions travel through the crystal until captured, forming F-centers. About 10^{14} to 10^{15} F-centers/cm^3 of KCl, KBr, or NaCl represents the lower limit of detection with the unaided eye. Various methods of inducing F-centers are described. Stability of F-centers depends on temperature; the mechanism of color stability is discussed. The thermal bleaching rate in KBr and KCl is too rapid for dosimetric purposes, but NaCl has a color-stable half life of several weeks. Thermal fading of F-center colorations at moderate temperatures may be minimized if the crystal is saturated with U-centers before exposure. A procedure is given for sensitizing KBr. Design of a colorimetric crystal dosimeter is proposed. Release of dosage energy in crystals containing F-centers by photoconduction and luminescence is described.

5433
SURVEY METHODS FOR FAST AND HIGH-ENERGY NEUTRONS. Burton J. Moyer. Nucleonics 10, No. 5, 14-19 (1952) May.

Eight methods for surveying neutrons in the ranges 0.3 to 15 Mev and 15 Mev up are discussed. The methods described for neutrons of 0.3 to 15 Mev are nuclear-track film, energy-insensitive counters, balanced chamber, the Bragg-Gray principle, directional count-rate meter for tissue dose, and fast-neutron energy-flux density. Higher-energy neutrons are detected by nuclear stars and recoils and Bi fission counters.

5434
A ROTATING-SHUTTER TIME-OF-FLIGHT SPECTROMETER FOR THE SLOW-NEUTRON RESONANCE REGION. W. Selove. Rev. Sci. Instruments 23, 350-6(1952) July. (cf. NSA 5-5303)

A high-speed rotating-shutter spectrometer has been built for making slow-neutron measurements in the resonance region, using a neutron pile as a source. One of the principal advantages of the new apparatus is that comparatively small samples are required, typically less than 1 g. The design and operation of the apparatus are described. (auth)

5435
PERFORMANCE OF PULSED PHOTOMULTIPLIERS. R. F. Post. Nucleonics 10, No. 5, 46-50(1952) May.

When short time of operation is not a limitation, pulsed scintillation counters can be used to obtain exceedingly short resolving times with high amplification and current output from the photomultiplier. The three most important operating characteristics of a photomultiplier for use in a high-resolution counting system are amplification, peak output current, and small time-dispersion of the amplified pulses. All three of these characteristics are improved by higher voltage operations of a photomultiplier. In almost all the experiments multipliers of the 931A and 1P21 types were used. Pulses were applied from a voltage-regulated high-voltage pulser. A great range of variability in the breakdown characteristics of different tubes when pulsed was observed. It is important to observe good h-f practice carefully in making the signal output connections. Since the multiplier amplifications obtained were about 10^9, oscillographic presentation was used for all the measurements. It was just possible to photograph single-electron noise counts from some of the tubes tried. A coincidence circuit was designed with resolving time comparable to the photomultiplier.

5436
FUNCTIONAL CLASSIFICATION OF PERSONAL DOSIMETERS. William A. Shurcliff. Nucleonics 10, No. 5, 86 (1952) May.

Two types of personal dosimeters are considered. One is to be used by a person entering an area he knows to be radioactive where he must consult his dosimeter at frequent intervals, and the other is to be issued to all persons in an area likely to be bombed in the event of atomic war. The names "counseling-type" dosimeter and "completion-type" dosimeter are proposed for these respective cases. In general the counseling dosimeter will be more elaborate than the completion dosimeter.

5437
MOUNT, ELECTRONICS, AND INDICATOR FOR PROBE COUNTER. Theodore Fields. Nucleonics 10, No. 5, 60-1 (1952) May.

A waterproof mount with a built-in preamplifier is mounted directly on a needle probe. A long shielded cable connects the probe unit to a counting-rate meter with indicator and timer. The preamplifier circuit can be slightly modified. The complete circuit is mounted on a permanently fixed terminal strip to which the ends of the five-conductor shielded cable are attached. The cable is fastened to the inside of the mount cylinder and is gasketed with a cement that is impervious to cold-sterilization solutions. The preamplifier uses a subminiature radio tube in a conventional cathode-follower circuit. The indicator and time alarm are connected to the modified counting-rate meter. For distant viewing an 8-in. meter is wired in parallel to the modified counting-rate meter. A synchronous motor with contact fingers rings a bell and switches on a light every 15 sec, at which time a reading may be taken.

5438
A MONITOR FOR NATURAL ATMOSPHERIC RADIOACTIVITY. M. H. Wilkening. Nucleonics 10, No. 6, 36-9(1952) June.

For studies of the time variation of atmospheric radon and thoron products, a moving-tape monitor has been built. An electrostatic precipitator deposits aerosol samples on the tape which then passes under a counter. The tape passes from the supply reel through the precipitator, under the detector, through rubber driving rollers, and on to the take-up reel. Ample tape is available for 2 weeks operation. It can be rewound, checked for long-lived background activity, and used again. The detector is usually a scintillation counter with a Ag-activated ZnS phosphor and an RCA 5819 photomultiplier tube and is used in connection with a count-rate meter having integrating-circuit time constants of 2.8 or 28 sec.

5439
LARGE-AREA LIQUID SCINTILLATION COUNTERS. F. B. Harrison. Nucleonics 10, No. 6, 40-5(1952) June.

Properties of liquid scintillators and associated photomultipliers are given. The design and construction of two types of scintillation counters are described. The important characteristics of the liquid scintillation counter are large counter volumes, fast response, high sensitivity to γ rays and fast neutrons, and a dependence of light output on rate of ionization loss. The large-area counters described are useful in cosmic-ray measurements whenever fast timing is required.

5440
FAST PULSE CIRCUIT TECHNIQUES FOR SCINTILLATION COUNTERS. F. H. Wells. Nucleonics 10, No. 4, 28-33 (1952) Apr.

Increased operating speeds result when secondary-emission pentodes are used in fast circuits. Besides circuits for scintillation counting, circuits have been designed for testing, calibration, and for displaying results. Fast scaling results when voltage pulses of short duration are used. Various circuits described include pulse-shaping circuits, pulse-generator circuits, amplifier circuits, fast oscilloscope circuits, and fast coincidence circuits.

5441
PULSE AMPLITUDE ANALYZERS FOR SPECTROMETRY. G. G. Kelley. Nucleonics 10, No. 4, 34-7(1952) Apr.

Pulse-height analysis is commonly accomplished by dividing the voltage-amplitude range available from a linear amplifier into increments or windows and determining counting rate in a number of these. Pulse-amplitude-analyzer design considerations include high speed, discrimination, beam deflection, pulse length, band width, and pulse spacing.

5442
AN AUTOMATIC SCANNER FOR PAPER RADIOCHROMATOGRAMS. Sidney Soloway, Frank J. Rennie, and DeWitt Stetten, Jr. Nucleonics 10, No. 4, 52-3(1952) Apr.

An automatic scanner for studying the distribution of radioactivity on paper chromatograms is described. Its advantages are rapid localization of radioactive materials along a unidimensional strip, ready estimation of R_f values

and relative abundances of radioactive material, and permanent recording of experiments.

5443

PRACTICAL PROCEDURES OF MEASUREMENT. Pt. III of THE RADIOISOTOPE. AEC Isotopes Div. Ralph T. Overman, tech. adviser. 1952. 16 mm film (PMF 5145c). B & W, sound, running time: 48 min. (cf. NSA 6-2840)

The film opens with an explanation that the radioisotope user is concerned with radiation measurements for (1) safety and for (2) experimental purposes. This film deals only with the latter. By way of introduction, several sequences cover the principles and use of various types of instrumentation, with emphasis on the G-M counter. Topics such as background, threshold value, plateau, and counting statistics are included. The remainder of the film is devoted to two types of activity measurements. The first type of measurement is called "absolute" measurement. The true activity of a sample is determined by using a calibrated standard. Sample preparation is demonstrated. The audience is introduced to the concepts of geometry, absorption, and scattering and is shown how to compensate for their effects. The second type of experiment is called "comparative" measurement. The activity of a radioactive sample is compared to that of a control sample in order to determine the quantitative change of activity by a process such as decay or dilution. Typical examples of comparative measurement are outlined.

5444

ELECTRICAL COUNTING RESPONSE OF TWO LARGE DIAMONDS UNDER BETA-IRRADIATION. K. Stratton and F. C. Champion. Proc. Phys. Soc. (London) B65, 473-80 (1952) July 1.

Two large diamonds S_1 and S_5, both of good optical quality, were subjected to β irradiation, and the electrical conduction responses were studied under a variety of conditions. With S_1 special attention was paid to the formation and removal of space charge. There is evidence that the mechanisms of space charge removal by β irradiation and by illumination respectively are not quite the same. The efficiency of this diamond as a β-particle counter was not appreciably different from that of a standard Geiger counter. Small volume elements of S_1 and S_5 were examined individually for β-counting efficiency. While S_1 did not show a variation greater than 20%, variations as large as ten to one were found in different parts of S_5. The results were not inconsistent with the existence of a correlation between the ultraviolet transmission and the counting efficiency of any selected volume element. The β response of S_1 was more than three times the best response from S_5 under comparable conditions. While the ultraviolet transmission limits were 2250 and 2850 A, respectively. (auth)

5445

ELECTRICAL COUNTING PROPERTIES OF DIAMONDS. F. C. Champion. Proc. Phys. Soc. (London) B65, 465-72 (1952) July 1.

Examination was made of over 200 diamonds, most of which were of gem quality and many of which weighed only a few milligrams. About 25 of them showed good conduction properties when submitted to ionizing radiations. For depths of crystal penetration which exceeded a certain amount, all the counting specimens responded to both α particles and β particles with a response which was at least qualitatively dependent on the energies of the particles. In some cases, however, a marked drop in the counting properties was easily demonstrated with α particles under conditions of feeble penetration. Even at maximum penetration 5-Mev α particles produced oscillograph pulses in such crystals which were only about three times as large as those from 1-Mev β particles. Strong correlation was established between the wavelength of the continuous ultraviolet transmission limit and the magnitude of the electrical counting response of the specimen. (auth)

5446

STUDY OF SEVERAL PHYSICOCHEMICAL FACTORS INFLUENCING THE LENGTH OF TRACKS IN NUCLEAR EMULSIONS. M. H. Braun. J. phys. radium 13, 347-54 (1952) June. (In French)

A systematic investigation of the effects of various factors on the length of tracks in Ilford nuclear emulsions is reported. Measurements of different observers were coherent. Underdevelopment had a shortening effect. Stopping power of Li-charged plates was the same as ordinary plates, but the stopping power of B-charged plates was decreased ~1.4%. Variation of stopping power was measured as a function of relative humidity at the time of exposure; this was found to be <1% for a relative humidity ≤58° in a Li-charged plate for which the effect of humidity was most marked. An increase in stopping power was noted on going from E1 to C2 to D1 emulsions. Ranges of ThC' (Po^{212}) and ThA (Po^{216}) α particles in E1 and C2 emulsions are given.

5447

DESIGN AND OPERATION OF A "MEAN DEVIATION METER." L. H. Greenberg and W. W. Happ. Can. J. Phys. 30, 317-28(1952) July.

An instrument was constructed and calibrated to measure the mean deviation of the counting rate from a series of pulses that are not uniformly spaced. Two resistance-capacitance 'memory' circuits measure the instantaneous and the average counting rates. A rectifier bridge circuit is used to compute the relative deviation. Over a large part of the range the response is linear and reproducible within 5% for full scale deflection. The instrument is used in conjunction with the counting of radioactive radiations; other uses are discussed. (auth)

5448

STATISTICS OF THE MEAN DEVIATION METER. E. S. Keeping and W. W. Happ. Can. J. Phys. 30, 329-41(1952) July.

The mean deviation is evaluated for a number of distributions of a Poisson or similar type, such as arise with counters, scaling circuits, and in particular with the mean deviation meter described by Greenberg and Happ (preceding abstract). The mean deviation for some distributions is fairly readily obtainable, but for the charge on a single tank circuit and also for the difference of charges on two tanks with different decay constants it is necessary to obtain the probability density. Exact expressions for these density functions are given, and also approximations from which the mean deviation can be calculated. (auth)

5449

BEHAVIOR OF IONS IN A SELF-CONTROLLED WILSON CHAMBER. H. de Laboulaye, C. Tzara, and J. Studinovski. J. phys. radium 13, 359-67(1952) June. (In French)

The behavior of ions created in an argon-octane mixture by Po α particles was studied in a cloud chamber operated by an internal counter arrangement. The mechanism of multiplication is illustrated, and the conditions necessary to operation of proportional counters are discussed. The ions were found to attain a stable state of aggregation rapidly. These aggregates had an average mobility of 0.9 $cm^2/v\text{-}sec$. The thermodynamic equilibrium of these aggregates is discussed.

5450

SPARK COUNTER FOR DETECTION OF ALPHA CONTAMINATION AND DETERMINATION OF THERMAL NEUTRONS. Pierre Savel. Compt. rend. 234, 2596-8(1952) June 30. (In French; cf. NSA 6-4869)

A Rosenblum-type spark detector (Phys. Rev. 67, 222 (1945)) operating at 4000 v is described. Since this counter

is sensitive specifically to α particles, it can be used to measure a thermal-neutron flux in the presence of γ rays by placing a screen of boron, or other substance producing α particles by the (n,α) reaction at a convenient counting rate, in front of the charged wires. Calibration and application to personnel protection are discussed.

5451
NOTES ON THE USE OF G.-M. TUBES. R. D. Phillips. Atomics 3, 169-72, 180(1952) July.

Although G-M tubes are now being used as radiation-detecting devices on a wide scale, the average user may not usually have experience with a sufficient number of tubes and tube types to be able to assess adequately the operating conditions under which optimum performance may be achieved. The author, from experience with one of the largest manufacturers of these instruments, suggests therefore the various precautions that should be observed to ensure satisfactory operation, and then considers separately those points peculiar to organic-vapor- and to halogen-quenched tubes. (auth)

MESONS

5452
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
SYNCHROTRON GROUP and THEORETICAL GROUP, p.208-22 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 15p. (AECU-2128(p.208-22))

Operation and maintenance of the synchrotron are briefly described. Experimental results obtained with a Be target are given on the mean life of the π^- meson and the ratio π^-/π^+ at angles of 90 and 135° to the synchrotron beam. μ^+ meson detection with the short γ-ray pulse is discussed. The report of the Theoretical Group consists of brief statements of current investigations concerning meson dynamics, nuclear theory, theory of nuclear reactions and scattering, etc.

5453
New York Univ.
I. ON THE MEAN LIFETIME OF μ-MESONS. II. THE VARIATIONS OF THE POSITIVE/NEGATIVE RATIO OF COSMIC RAY μ-MESONS WITH MOMENTUM AND ALTITUDE, by H. A. Morewitz and M. H. Shamos. June 26, 1952. 15p. (NYO-3347)

I. The mean lifetime of μ-mesons in C and S has been measured by the delayed-coincidence technique. The lifetime of the μ^+ meson in S is $\tau_S^+ = 2.09 \pm 0.05$ μsec. This compares favorably with values found in materials of low atomic number, but there is a statistically significant difference between it and a recent measurement in Fe. The lifetime of the μ^- meson in C is $\tau_C^+ = 1.92 \pm 0.03$ μsec, a value compatible with Wheeler's theory and other lifetimes determined in materials of higher Z. II. The μ^+/μ^- ratio at a momentum of ~325 Mev/c at sea level obtained from the time distribution of the delayed coincidences in C and S is $\mu^+/\mu^- = 1.06 \pm 0.03$. When this ratio is compared with other "selected" experiments performed at various altitudes by plotting all ratios as a function of momentum from the top of the atmosphere, then the best fit to the experimental points is given by: $P = P_0 \exp[(\mu^+/\mu^-)/0.38]$, where $P < 4$ bev/c and $P_0 \simeq 0.165$ bev/c = 35 mb. It is concluded that there is no appreciable meson production in the atmosphere above ~35 millibars and below ~590 millibars. (auth)

5454
Radiation Lab., Univ. of Calif., Berkeley
PHYSICS DIVISION QUARTERLY REPORT [FOR] FEBRUARY, MARCH, AND APRIL, 1952. June 16, 1952. 46p. (UCRL-1854)

Brief reports are presented of the status of various experiments in nuclear physics. Data are given on the following investigations: analysis of spallation process; absolute yield of π^0 mesons in proton bombardment of C; variation of π^0 yield with atomic number of proton-bombarded targets; cross sections for products of 90-Mev neutrons on C; comparison of electron and charged-meson yields from proton bombardment of C; ratio of negative and positive mesons from C bombarded by high-energy neutrons; electron-positron annihilation in flight at 200 Mev; angular distribution of π^+ mesons from 340-Mev protons on protons; charged-pion production at 180° from 340-Mev protons on C; excitation function for the reaction $p + p \rightarrow \pi^+ + d$; and operation and development of the 60-in. cyclotron.

5455
THE RELATIVE SPECIFIC IONIZATION OF FAST MESONS. R. S. Carter and W. L. Whittemore. Phys. Rev. 87, 494-9 (1952) Aug. 1.

An experiment has been performed with cosmic mesons to study the specific ionization in the relativistic region. A cloud chamber was used to measure the rate of droplet production for two groups of mesons, one with momentum p between 70 and 250 Mev/c and the other with $p > 1500$ Mev/c. These two groups of momenta were selected by the appropriate arrangement of Geiger counters. The cloud chamber used to measure the ionization was also used to measure the magnetic rigidity of the particles in the lower group of momenta. The particles in the other group produced tracks which were essentially straight in the magnetic field of 4800 gauss. The group of mesons with lower momenta ionized at or near the minimum rate which was determined to be 14.7 ± 0.35 droplets/mm on the photographic film. The other group of mesons gave an experimental average of 17.9 ± 0.25 droplets/mm, in good agreement with the value of 18.5 droplets/mm, predicted on the basis of the Bethe-Bloch ionization theory and the accepted momentum spectrum for sea-level cosmic mesons. The good agreement obtained between the experimental and theoretical distributions shows that the present ionization theory with its rise in the relativistic region adequately describes the observed rate of energy loss for energetic mesons with values of p/μ up to approximately 100. Too few mesons were available with momenta large enough to check the effect of polarization in He. (auth)

NUCLEAR PHYSICS

5456
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
ONR GENERATOR GROUP and RADIOACTIVITY AND CYCLOTRON GROUP, p.153-207 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 55p. (AECU-2128(p.153-207))

The first portion deals with operation of the ONR generator. Operation with a proton beam of 7 Mev has been achieved, and some data have been taken at this energy. The second portion presents final results on nuclear-reaction Q values and nuclear energy levels as studied by means of the 2-Mev generator. Data are presented on the following reactions: $F^{19}(d,p)$, $F^{19}(d,\alpha)$, $Na^{23}(d,p)$, $Mg^{24}(d,p)$, $Al^{27}(d,\alpha)$, $Mg^{25}(d,p)$, $Mg^{26}(d,p)$, $Mg^{25}(d,\alpha)$, and $P^{31}(D,p)$. The report of the radioactivity and Cyclotron Group includes discussions of the following: Zeeman effect in positronium; internal conversion in Rb^{85}; effect of chemical state on angular correlation of the γ rays of In^{111}; proportional counting of C^{14} in the gas phase; absorption of Co^{60} γ rays in Cu, Sn, Ta, and Pb; average energy of secondary electrons in anthracene due to γ irradiation; energy levels of Na^{23} and Al^{27}; angular distributions of protons inelastically scattered by C^{12} and Mg^{24}, angular distributions of protons from $Be^9(d,p)$ and $C^{12}(d,p)$; and binding energy of the last neutron in the $Bi^{209}(d,p)$ reaction.

5457
Radiation Lab., Univ. of Calif., Berkeley
SYMMETRICAL PSEUDOSCALAR MESON THEORY OF NUCLEAR FORCES, by Joseph V. Lepore. July 3, 1952. 8p. (UCRL-1881)

Nuclear forces yielded by the symmetrical pseudoscalar theory are discussed in terms of a perturbation expansion. It is shown that up to terms in the square of the coupling constant that the pseudoscalar coupling is equivalent to a scalar pair coupling of the pseudoscalar field plus a pseudovector coupling of that field. The dominant contribution to the fourth order nucleon potential is then obtained in a simple way by using this result. (auth)

5458
PROPERTIES OF RADIATION. Pt. II of THE RADIOISOTOPE. AEC Isotopes Div. Bernard G. Saunders, tech. adviser. 1952. 16 mm film (PMF 5145b). B & W, sound, running time: 64 min. (cf. NSA 6-2840)

In the introductory sequences, a demonstrator uses a Geiger counter to compare the penetrations of α, β, and γ radiation and to derive their characteristic absorption curves. In the section concerned with the properties of β radiation, the audience is introduced to the cloud chamber, electrostatic generator, and β-ray spectrometer. The concepts of ionization, electron volt, β spectrum, neutrino, scattering, nonlinear absorption, and density thickness (mg/cm^2) are discussed. In the section concerned with the properties of γ radiation, the following concepts are introduced: bremsstrahlung, photoelectric effect, compton scattering, pair-production, exponential absorption, absorption coefficient, and half-thickness. The film concludes with a section on the interpretation of composite absorption curves, such as are obtained in counting samples emitting β's having two E_{max}, β and γ, or positron and annihilation radiation.

NUCLEAR PROPERTIES

5459
Wyoming Univ.
NUCLEAR MAGNETIC RESONANCE PROJECT PROGRESS REPORT FOR MARCH 15, 1951 TO SEPTEMBER 1, 1951; STEADY STATE TRANSIENTS IN NUCLEAR RESONANCE AND THE NUCLEAR RELAXATION TIME, T_2, FOR HYDROCARBONS. [nd] 44p. (AECU-2131)

The Bloch formulation of nuclear magnetic resonance is applied to a repeated pulsing of the external alectromagnetic field H_1. The steady-state solution is shown to predict the existence of sidebands, a mirror signal, and magnetic field inhomogeneity effects. All these effects are shown to be verified experimentally, thus strengthening the applicability of the Bloch formulation to transient problems. The solution given was used to determine T_2 from the observed transient signals for liquid hydrocarbons. From this T_2 data it is argued that there is a strong relation between the values of T_2 and the molecular structure of the hydrocarbons. In fact, an increase in the value of T_2 implies an increase in the symmetry of the molecules. Appendix A consists of a theoretical analysis of Bloch equations for repeated pulses (or steady-state transients). Appendix B contains a detailed description of the equipment used at the University of Wyoming. (auth)

5460
Wisconsin Univ.
STRUCTURE OF THE NUCLEON, by R. G. Sachs. [nd] 47p. (AECU-2134)

An attempt is made to determine what restrictions are imposed on the nucleon wave functional by the known values of the nucleon moments and by the neutron-electron interaction. The nucleon is assumed to consist of a core particle (nucleore) of spin ½ surrounded by a pion field. No detailed reference is made to the interaction producing the field. Nucleore recoil is neglected. It is found that the neutron and proton moments satisfy a mirror condition

$$\mu_n + \mu_p = 1 - (\tfrac{1}{2})\, P_1$$

where P_1 is the probability that pions (any number or charge) occur in the field with total orbital angular momentum L = 1. Insertion of the measured values of the moments in the equation yields P_1 = 9 per cent. A model of the nucleon in which one pion plays the predominant role is not consistent with this result. This is probably the underlying reason for the failure of the weak-coupling theory to give the correct ratio of neutron to proton moments. The neutron and proton moments can be accounted for if the field contains at least two pions with appreciable probability. A successful model consists of 91 per cent bare nucleore and 9 per cent a pair of mesons, each in p states forming the state L = 1. The neutron-electron interaction is shown to depend on the mean square radius of the charge distribution, $\overline{r^2}$, in the nucleon. If only one or two pions with L = 1 are contained in the proper field with appreciable probability, the observed interaction combined with the above value of P_1 leads to the very reasonable value of the mean square displacement of a pion, $\langle (\mu r)^2 \rangle \approx 0.5$, where μ is the compton wave length of the pion. The results suggest strongly that a weak nonlinear coupling would be capable of accounting for the data, but a linear coupling of intermediate strength cannot be excluded. An analysis of the pseudoscalar field in terms of spherical waves is given in the appendix. Consideration is also given there to the space- and time-inversion properties of the field functionals. (auth)

5461
Wisconsin Univ.
ON THE CONSERVATION OF ISOTOPIC SPIN IN NUCLEAR REACTIONS, by Robert K. Adair. [nd] 9p. (AECU-2149)

The possibility of obtaining information on the charge independence of nuclear forces from nuclear reaction experiments is discussed. It is pointed out that charge independence establishes relations between cross sections for some reactions and results in forbidding certain other reactions. (auth)

5462
ENERGY LEVELS IN C^{12}, Al^{27}, AND Na^{23} USING A SCINTILLATION SPECTROMETER FOR HEAVY PARTICLES. H. F. Stoddart and H. E. Gove. Phys. Rev. 87, 262-6(1952) July 15.

Energy levels in C, Al, and Na have been measured using a "proportional" NaI scintillation counter to determine energies of outgoing protons from inelastic proton scattering at 7.26 Mev with the following results: C^{12}: 4.45 Mev; Al^{27}: 0.84, 1.01, 2.23, 2.77, 3.03, 3.71, 4.00, 4.47, 4.60, 4.87, 5.43 Mev; Na^{23}: 2.10, 2.37, 2.69, 3.01, 3.70, 3.92, 4.45 Mev. Factors limiting the resolution are presented, and it is found that the standard deviations of the distributions are consistent with 2.4 photoelectrons produced at the photocathode of the RCA 5819 per kev of particle energy lost. (auth)

5463
DETERMINATION OF THE MAGNETIC MOMENT OF AN EXCITED NUCLEUS (Cd^{111}). H. Aeppli, H. Albers-Schönberg, H. Frauenfelder, and P. Scherrer. Helv. Phys. Acta 25, 339-70(1952) June 30. (In German)

A method for determining the g-factor of the intermediate state of a nuclear γ-γ cascade is described. The method consists in measuring the angular correlation of the two successive γ rays as a function of an external magnetic field perpendicular to the plane of the γ rays. A full account is given of the apparatus and of the various corrections involved in the measurement. The method has been applied to the cascade of Cd^{111}, giving a g-factor of $g = -0.28 \pm 0.05$ for

the intermediate (247-kev) level. Because this state has a spin of ⅝, the magnetic moment becomes μ (247 kev) = −0.70 ± 0.12 n.m. (auth)

5464
NUCLEON MOMENTUM DISTRIBUTIONS IN DEUTERIUM AND CARBON INFERRED FROM PROTON SCATTERING. J. B. Cladis, W. N. Hess, and B. J. Moyer. Phys. Rev. 87, 425-33(1952) Aug. 1. (cf. NSA 6-1841)

Nuclear internal-momentum distributions of D, C, and O are inferred from the energy distributions of the protons obtained at various scattering angles when 340-Mev protons are incident on these nuclei. The energy spectra of the protons from D agree with the spectra obtained theoretically by using the deuteron nucleon-momentum distribution given by the Fourier transform of the Hulthén wave function. Unfortunately, the experimental method is not so good as to distinguish differences in the portion of the deuteron wave function within the potential interaction. Protons obtained from C and O have energy spectra that are consistent with the use of a Gaussian nucleon-momentum density distribution having a 1/e value corresponding to a nucleon energy of 16 ± 3 Mev. Proton yields from D nearly equal those expected from free proton-nucleon collisions. O gives proton yields in the spectral regions investigated that are 16/12 times the corresponding yields from C. (auth)

5465
NUCLEAR RADIOFREQUENCY SPECTRA OF H_2 AND D_2 IN HIGH AND LOW MAGNETIC FIELDS. H. G. Kolsky, T. E. Phipps, Jr., N. F. Ramsey, and H. B. Silsbee. Phys. Rev. 87, 395-403(1952) Aug. 1.

A new molecular-beam apparatus of improved design is described which utilizes, among other improvements, a long homogeneous magnetic field with two separated oscillatory fields for high resolution and a method of phase shifting of the two fields which permits more accurate data-taking. The apparatus has been used to study the nuclear radiofrequency spectrum of H_2 and D_2 in magnetic fields of 1600 and 6 gauss. The results are found to be consistent with Ramsey's theoretical expressions (Phys. Rev. 78, 695 (1950)) provided the adjustable parameters are suitably selected. For H_2 the values for these parameters are that c equals 113,800 ± 210 cps and d equals 57,680 ± 40 cps, while for D_2 c equals 8790 ± 60 cps and d equals 25,240 ± 20 cps. These values for the parameters imply that the rotational magnetic field H′ at the nucleus in H_2 is 26.73 ± 0.05 gauss while in D_2 it is 13.44 ± 0.09 gauss, that the internuclear spacing r in H_2 is such that when averaged over the zeroth vibrational state and the first rotational state $\langle 1/r^3 \rangle^{-1/3}$ equals 0.74673 ± 0.00018 × 10^{-8} cm, that the deuteron quadrupole interaction $eQ(\partial^2 V^e/\partial z_0^2)$ equals 1.4907 ± 0.0015 × 10^{-21} erg, that the quadrupole moment Q of the deuteron equals 2.738 ± 0.014 × 10^{-27} cm^2, and that the nuclear magnetic shielding constant σ for H_2 is 2.65 ± 0.03 × 10^{-5}. (auth)

5466
NUCLEAR QUADRUPOLE RESONANCE FREQUENCIES OF COPPER NUCLEI IN POLYCRYSTALLINE COPPER COMPOUNDS. H. Krüger and U. Meyer-Berkhout. Z. Physik 132, 171-8(1952).

The nuclear quadrupole frequencies in the meter wavelength region of Cu^{63} and Cu^{65} were determined in polycrystalline Cu_2O and $K[Cu(CN)_2]$ at +16 and −186°C. In all cases the ratio of the moments $Q(Cu^{63})/Q(Cu^{65})$ was 1.0806 ± 0.0003. The bond structures of the compounds are discussed.

5467
DETERMINATION OF THE MAGNETIC MOMENT OF THE As^{75} NUCLEUS FROM THE ZEEMAN EFFECT OF A NUCLEAR QUADRUPOLE RESONANCE TRANSITION. H. Krüger and U. Meyer-Berkhout. Z. Physik 132, 221-30 (1952). (In German)

An absorption line of frequency ν_Q = 116.26 ± 0.02 Mc was observed in polycrystalline As_2O_3 (As_4O_6) at room temperature. This line arises from a resonance transition between two terms of the As^{75} nucleus, the energy difference of which is determined by interaction of the As nuclear quadrupole moment with the inhomogeneous electric field of the molecule. In an As_2O_3 single crystal a magnetic splitting of this nuclear quadrupole resonance transition was observed. The nuclear magnetic moment of As was determined from the Zeeman effect in a magnetic field of ~100 gauss to be μ_I = 1.44 ± 0.03 n.m.

NUCLEAR REACTORS

5468
Los Alamos Scientific Lab.
FAST NEUTRON SPECTRA FROM THE WATER BOILER, by John E. Evans. Mar. 1951. 33p. (LA-1395)

Fast-neutron spectra have been measured for beams emerging from (1) the sphere surface, (2) the face of the Bi column, and (3) a graphite face 1 ft in front of the Bi column in the north thermal column of the water boiler. Nuclear-plate techniques have been used. The spectra can be roughly approximated by a fission spectrum above 1 Mev. The source strength for fission neutrons in the forward direction for the emitting surfaces and the flux of fission neutrons received by a sample placed against these surfaces are given in the following table:

Emitting Surface	Source Strength neuts/steradian/sec/kw/cm^2 of surface	Max. Flux neuts/cm^2/sec/kw
Sphere	5.2×10^9	6.5×10^{10}
Bismuth column	1.2×10^8	1.5×10^9
Graphite	3.5×10^6	4.4×10^7

Appendix I gives the derivation of an expression for the fraction of recoil protons accepted by given angular criteria. In Appendix II the expression $e^{-E} \sinh \sqrt{2E}$, which closely fits the prompt neutron spectrum from fission, has been integrated, and a table of ordinates and normalized areas for the expression is given. (auth)

5469
Los Alamos Scientific Lab.
"WATER BOILER" SOLUTION HANDLING SYSTEM, by J. E. Evans. Mar. 1952. 12p. (LAMS-1396)

A well-shielded stainless-steel solution-handling system for the water boiler has been designed and installed. One year of experience has shown that it is very satisfactory. The report discusses the construction details and operation procedures. (auth)

NUCLEAR TRANSFORMATION

5470
Los Alamos Scientific Lab.
FISSION NEUTRON SPECTRUM OF Pu^{239}, by Norris Nereson. [nd] 5p. Decl. July 16, 1952. (AECD-3428; LADC-1215)

The neutron spectrum from the fission of Pu^{239} by thermal neutrons has been measured. A Ni-coated-disk sample of Pu^{239} was irradiated in the thermal-neutron beam of the Los Alamos water boiler, and the spectrum data were accumulated from a total of ~5500 proton recoil tracks in C2 nuclear emulsion plates placed at right angles to the thermal-neutron beam. The results show that the fission neutron spectra of Pu^{239} and U^{235} are identical within the statistical errors of the two experiments (cf. Phys. Rev. 85, 600(1952)). Each of these spectra attains a maximum intensity in the 0.6 to 0.8-Mev region and possesses an exponential slope at energies

beyond 2 Mev. The average energy of the spectrum is 2.0 Mev.

5471
Wisconsin Univ.
NUCLEAR PHOTOPROCESSES AT HIGH ENERGY, by J. G. Brennan and R. G. Sachs. [nd] 13p. (AECU-2135)

A theoretical value of the cross section for "ordinary" photodisintegration (i.e., those processes not involving pion photoproduction), at photon energies ≥140 Mev, is derived. An appropriate definition of the high-energy (irreducible) multiple moment is given. It is shown that the Siegert theorem does not apply, so even the electric dipole transition may be affected by (adiabatic) exchange currents. These and other high-energy effects are found to contribute about 5% to the electric-dipole photodisintegration cross section of the deuteron. Larger corrections are anticipated for heavier nuclei. It is shown that the corrections are calculated most readily by using the usual form of the multiple moment operators, rather than the formally correct irreducible operators.

5472
Argonne National Lab.
NEUTRON CAPTURE γ-RAY SPECTRA FROM THE ELEMENTS Z = 17-30 AND Z = 45-57, by Bernard Hamermesh and Virginia Hummel. June 13, 1952. 17p. (AECU-2136)

A NaI (Tl) scintillation counter and a 5819 photomultiplier have been used in conjunction with a very accurate and flexible 20-channel pulse-height discriminator to study thermal-neutron-capture γ-ray spectra. The energy range 20 kev to 10 Mev was studied for the elements of atomic numbers 17 to 30 and 45 to 57 excluding the noble gases. In the case of Cl, four lines were found below 2.1 Mev. These probably correspond to the first four excited states of Cl^{36}. A neutron binding energy of 8.57 ± 0.03 Mev was found for Cl^{36} by combining these lines with pair-spectrometer data on the high-energy lines. The method yields information on only the most prominent transitions in the capture γ decay schemes. No systematic distribution of these prominent lines is evident from the limited number of lines that can be resolved by this technique. (auth)

5473
Wisconsin Univ.
DEUTERON BOMBARDMENT OF Be^9 AND CLASSIFICATION OF LEVELS OF B^{10}, by Fay Ajzenberg. [nd] 19p. (AECU-2158)

Previous measurements on the $Be^9(d,n)B^{10}$ neutron spectrum at 0 and 80° have been extended to 10, 30, and 45° to check the energy-level assignments and to deduce the parity of the levels from a Butler analysis of the angular distributions. The observed neutron groups correspond to levels of B^{10} at 0.72, 1.75, 2.15, 3.53, 4.78, 5.14 (doublet), 5.37 (?), 5.58, 5.72 (?), 5.93, 6.12 (possibly doublet), 6.38, 6.58, and 6.77 Mev. The estimated uncertainty is 0.06 Mev for the first five states of B^{10} and 0.04 Mev for the higher energy levels. The Butler analysis of the angular distribution data indicates that the ground state and the first four excited states of B^{10} are of even parity and that both components of the 5.14-Mev doublet are probably odd-parity states. Parity assignments for some of the other energy levels have been attempted. The spins of these states cannot be uniquely determined on the basis of the Butler analysis, but the possible spin limits are listed. A $Be^9(d,p)Be^{10}$ exposure was also made. There do not appear to be any states in Be^{10} between the ground state and the known 3.37-Mev level. (auth)

5474
Oak Ridge National Lab.
HIGH-VOLTAGE PHYSICS AND RADIOACTIVITY AND NUCLEAR ISOMERISM GROUPS, p.2-12 of PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1951, by W. M. Good, ed. Issued Aug. 8, 1952. 11p. (ORNL-1278(p.2-12))

The $H^3(p,n)He^3$ reaction has been investigated from threshold to 5.0 Mev; graphs show the differential and total cross sections and angular distribution. The total neutron cross section of ordinary Fe has been measured from 0.7 to 3.6 Mev; the graph indicates many unresolved resonances. Inelastic scattering of neutrons by elemental Fe has been studied with a NaI scintillation counter; an increase in γ activity at a neutron energy of ~0.8 Mev is probably due to inelastic scattering in Fe^{56} by the 0.822-Mev level. Threshold determinations for (p,n) reactions on F^{19}, Na^{23}, Cu^{63}, Cu^{65}, Nb^{93}, and In^{115} have been made. The $Li^6(t,p)Li^8$ reaction has been experimentally identified by observation of the β particles from Li^8 decay to Be^{8*}. Thin-target yield curves are presented for the reactions $D(t,n)He^4$ and $D(He^3,p)He^4$. The internal-conversion coefficients for the 132-kev γ of Ta^{181}, following β decay of Hf^{181}, and the 70- and 102-kev γ rays of Eu^{153}, following β decay of Sm^{153} or K-capture decay of Gd^{153}, have been determined by means of a scintillation spectrometer. The angular correlations of γ rays from excited states of Pd^{106} have been determined, and spins are suggested for the three levels.

5475
Radiation Lab., Univ. of Calif.
METHODS OF CALCULATING YIELDS IN CHAINS OF SUCCESSIVE NUCLEAR TRANSFORMATIONS, by John O. Rasmussen, Jr. and Rosemary J. Barrett. May 26, 1952. 28p. (UCRL-1835)

The mathematical problem of calculating the yield of an isotope produced in a chain of first-order transformation processes is discussed. Several new approximation formulas are derived, as well as the well-known general exact solution. A sample calculation of the pile yield of isotopes in a chain of radiative neutron capture processes is carried out, illustrating a method of tabulation designed to minimize numerical errors. (auth)

5476
ANGULAR CORRELATIONS IN THE $Li^6(d,p)Li^{7*}(\gamma)Li^7$ REACTION. C. M. Class and S. S. Hanna. Phys. Rev. 87, 247-51(1952) July 15.

The yield of radiation in the $Li^6(d,p)Li^{7*}(\gamma)Li^7$ reaction has been measured as a function of angle in correlation with protons observed in the direction of the beam and with the beam alone. No anisotropy was detected in either observation. The only plausible theoretical explanation of these results is the assignment of I = ½ to the first excited state of Li^7 in agreement with other recent observations. (auth)

5477
ANGULAR CORRELATION BETWEEN PROTONS AND GAMMAS IN THE $Li^6(d,p\gamma)Li^7$ REACTION. W. H. Burke and J. R. Risser. Phys. Rev. 87, 294-6(1952) July 15.

The angular correlation between protons and gammas in the reaction $Li^6(d,p\gamma)Li^7$ has been experimentally determined for the purpose of obtaining information on the 480-kev excited state of Li^7. A bombarding energy of 500 kev was used, so that the Be^{8*} intermediate nucleus would be formed in the 22.5-Mev excited state reported by Whaling and Bonner (Phys. Rev. 79, 258(1950)). No correlation was observed within the statistical accuracy of the experiment. (auth)

5478
SELECTION RULES IN NUCLEAR REACTIONS. A. Gamba, R. Malvano, and L. A. Radicati. Phys. Rev. 87, 440-3(1952) Aug. 1.

The symmetry properties of nuclear wave functions and Hamiltonian operators with respect to the symmetric permutation group are discussed in order to get selection rules

for the decay of a nucleus after absorption of an electromagnetic or mesonic radiation. As an illustrative example of the method, a simple case of photodisintegration of the α particle has been studied. (auth)

5479
EVIDENCE FOR A (n,α) REACTION IN IRON. J. P. Lonchamp. J. phys. radium 13, 333-8(1952) June. (In French)

Ilford E1 and D1 were partially covered with a 10-μ-thick film of Fe and exposed to an intense thermal neutron flux. An excess of tracks was observed in the covered portion. Problems of track discrimination and contamination are discussed. The value $10^{-28} \leq \sigma \leq 2.4 \times 10^{-28}$ cm^2 is proposed for the cross section of the $Fe^{56}(n,\alpha)Cr^{53}$ reaction. This value differs from those proposed to date. A semitheoretical calculation of the cross section is carried out on the basis of recent theories of α disintegration.

5480
STATE OF POLARIZATION OF THE PRODUCTS OF THE D + D REACTION. M. Cini. Nuovo cimento (9) 8, 1007-10 (1951) Dec. (In Italian)

The problem of polarization of the He^3 + n or H^3 + p resulting from the reaction of unpolarized deuterons has been studied theoretically by Blin-Stoyle (NSA 5-6895) and Beiduk et al. (NSA 4-2782). The present paper clarifies certain features of the theory, calculates the maximum value of the polarization, and suggests problems needing experimental investigation.

PARTICLE ACCELERATORS

5481
Radiation Lab., Univ. of Calif.
RESONANCE MAPS FOR LINEAR ACCELERATORS, by Sumner W. Kitchen and Robert G. Smits. Feb. 27, 1952. 34p. (UCRL-1739)

In the design of resonant accelerators, it is desirable to choose parameters of resonance which can be related to particle motion such as g/l and β, where g is the gap space, l is the distance between planes of electrical symmetry in successive gaps or drift tubes, and $\beta = v/c$. If the mode and drift-tube configuration are chosen, there remain only four independent variables for resonance. Resonance maps are presented for g/l and β as functions of drift tube diameter and length and of frequency for a fixed cavity diameter. Methods of using this data in designing a resonant system of any size are indicated. (auth)

5482
BERKELEY CYCLOTRON OIL DIFFICULTIES. J. Vale. Nucleonics 10, No. 5, 61-2(1952) May.

Progressive heating of the lower coil tank of the Berkeley cyclotron during the last 2 yr was observed. The heat exchanger was dismantled, and a green viscous material was found deposited on the inside surfaces. This material was about ⅛ in. thick and prevented proper heat flow. Analysis of the substance showed that it was an organic Cu soap usually formed by oil-derived acids attacking the Cu. The system was cleaned and filled with Wemco CI oil, which contains inhibitors to destroy the catalytic action of Cu in oxidizing the oil. It is recommended that if the oil acidity reaches a neutralization number of 0.3 the oil be discarded and that moisture be kept out of the oil. The best solution is to have a sealed system which can be kept under dry N_2. The operating temperatures should be kept low.

5483
1.2-MEV ACCELERATOR AT THE AUSTRALIAN NATIONAL UNIVERSITY. E. W. Titterton. Nucleonics 10, No. 5, 28-9 (1952) May.

Each stage of the seven-stage voltage-multiplying circuit is rated at 200 kv, and an open-circuit voltage of 1.4 Mv is expected. At the rated load of 3 ma, with the first stage near its rated voltage, a terminal voltage of 1.2 Mv is obtained. The generator circuit is shown schematically and described. A smoothing column of capacitors is used to supply appropriate d-c voltages to the lenses of the seven-stage accelerator tube. The entry and exit lens apertures are 2.5 and 2.0 cm in diameter, respectively. The lens faces and the toroid crowning the shield are of highly polished stainless steel, and the rest of the electrode structure is mild steel. The pumping system consists of a mechanical pump backing up an 8-in. diffusion pump. An oliphant-type ion source is used. The focus 5 ft from the bottom lens is such that a spot 5 mm in diameter containing 200 μa of beam can be held from 450 kv to maximum. The largest beam to date was 300 μa at 880 kv. The accelerator stands on the roof of the 40 by 25-ft target room. The beam enters the target room vertically and is turned 90° by a magnet.

5484
CYCLOTRON SAFEGUARDS. Francis L. Brannigan, Hanson Blatz, and Edward J. Kehoe. Nucleonics 10, No. 5, 20-4 (1952) May.

Specific dangers of cyclotron operation and methods of avoiding them are described. Fire and accident considerations discussed are cyclotron cooling media, flammable liquids, paraffin fire hazard, fire alarms, building, control-room paneling, storage space and tidiness, and personnel safeguards. Radiation protection is discussed, and target handling and shielding are described.

5485
AXIAL MOTION OF AN ELECTRON IN A CONSTANT WAVE VELOCITY SECTION OF A LINEAR ACCELERATOR. David Caplan and Edward Akeley. J. Applied Phys. 23, 774-8(1952) July.

The relativistic differential equations for the axial motion of an electron in a wave guide, excited by a progressive, sinusoidal, longitudinal, electric wave of constant speed less than that of light in vacuum, have been integrated. The first integral yields the results of J. C. Slater (Revs. Modern Phys. 20, 505(1948)) and gives the energy-phase relationship, which is periodic. A second integration yields the phase distance relationship and thus completes the determination of the orbits. All separatrices are exactly integrable in terms of trigonometric and hyperbolic functions, while the general case requires elliptic integrals of the first and third kinds. The former are obtainable from tables, while the latter are evaluated by series expansions, or in the case of particles near the self-crossing point of the separatrices where the convergence of the series expansion is slow, by the use of the addition theorem for elliptic integrals of the third kind. These results are applied to the case of the proposed new Purdue Linear Accelerator. Energy distribution of the particles coming out of the end of the first two sections of this accelerator is in this way obtained. (auth)

RADIATION ABSORPTION AND SCATTERING

5486
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
ELEMENTARY PARTICLE SCATTERING GROUP and M.I.T.-O.N.R. GENERATOR CONSTRUCTION AND HIGH VOLTAGE RESEARCH GROUP, p.43-102 of PROGRESS REPORT [FOR PERIOD JUNE 1, 1951 TO MAY 31, 1952]. May 31, 1952. 60p. (AECU-2128(p.43-102))

The nuclear interaction between protons has been investigated by determining the energy of the minimum in the ratio of p-p scattering to Mott scattering at 45° room to be 383 ± 3 kev. The total neutron cross section of H at 1.320 ± 0.003 Mev has been measured as 3.68 ± 0.02 barns. The total n-D cross section was investigated at four energies from 0.100

Mev to 1.3 Mev by comparing the transmission of Li(p,n) neutrons by BeO with the transmission by a sample fabricated from Be metal and D. Data are presented on the relative yields of various photonuclear reactions of As irradiated in a 320-Mev bremsstrahlung beam. Results obtained in measurements of the angular distribution of photofission fragments from Th are listed. As a test of the evaporation theory of photonuclear reactions, experiments are being performed to study the emission of fast photoneutrons from Ta and other heavy metals. A scintillation technique is described in some detail for the detection and energy selection of protons in the 100- to 250-Mev range; several graphs are included which show energy loss in the NaI crystals as a function of initial proton energy. The method was used to study photoproton emission from C, Al, and Fe; and data are presented on the number, energy, and angular distribution of the emitted protons. The report of the MIT-ONR Generator Construction and High Voltage Research Group includes data on the following: secondary emission of electrons from targets of Al, Pb, Au, and Fe under N_2-ion bombardment; factors influencing the performance of high-voltage acceleration tubes; insulating properties of SF_6; and outgassing properties of materials commonly used as gasket materials in acceleration tubes, e.g., Teflon, Myva-seal, and polyethylene.

5487

Los Alamos Scientific Lab.

INELASTIC COLLISION CROSS SECTION OF NITROGEN FOR 14-MEV NEUTRONS, by M. E. Battat. May 1952. 4p. (LA-1412)

The cross section for inelastic scattering of 14-Mev neutrons by N has been measured by using Cu, Al, and U^{238} threshold detectors with thresholds at ~11.5, 2.6, and 1 Mev, respectively. The liquid N_2 was contained in a spherical dewar, and a double-walled test tube was inserted into the liquid to provide for placement of the detectors. The data obtained for the various threshold detectors and the corresponding inelastic collision cross sections are tabulated.

5488

Los Alamos Scientific Lab.

THE RECIPROCITY THEOREM IN NEUTRON SCATTERING, by H. A. Bethe. June 20, 1952. 18p. (LA-1428)

A proof of the reciprocity theorem for the neutron scattering by spherical shells is given. The theorem does not state that the transmission of the sphere is independent of the distance between source and detector, and the correction for finite distance is calculated. It is verified from the elementary scattering laws that the total transmission is unity for a sphere which scatters only elastically, and a certain paradox arising from the reciprocity theorem is resolved. (auth)

5489

Nuclear Development Associates, Inc.

BOUNDS TO A DISTRIBUTION FUNCTION ARISING IN γ-RAY STUDIES OBTAINED FROM ITS MOMENTS, by Stanley Preiser. June 15, 1952. 11p. (NYO-3073)

In applying a Spencer-Fano-type analysis to a plane monodirectional, monoenergetic, unit source of γ rays penetrating an infinite slab of homogeneous material, the moments of a distribution function $F(x,\lambda)$ governing the transmission of the γ rays are first computed. Using the method of Zelen (Ann. Math. Statistics 22, 315(1951)) for obtaining bounds to a distribution function employing these moments, the author has computed such bounds for 3-Mev γ rays generated from a plane monodirectional source in Pb. These bounds are listed as functions of wavelength. Bounds to the total current are then calculated.

5490

ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED BY He^4. P. Huber and E. Baldinger. Helv. Phys. Acta 25, 435-40(1952) June 30. (In German)

The angular distribution of neutrons elastically scattered by He^4 was measured in the energy region 3 to 4.14 Mev. A phase analysis, in which was included experimental data of Adair (Phys. Rev. 86, 155(1952)) in the energy range 0.4 to 2.7 Mev, indicated a $P_{3/2}$ level as the lowest He^5 state and a $P_{1/2}$ level 1.76 Mev higher.

5491

INTERACTION OF PHOSPHORUS-32 BETA RAYS WITH MATTER. Gordon L. Brownell. Nucleonics 10, No. 6, 30-5(1952) June.

The energy distribution of β rays from a thin P^{32} source mounted on collodion film has been measured before and after addition of various absorbers and backscatterers. The angular distribution also has been determined. The average energy curves can be considered to be the result of a marked drop in the average energy of radiation emitted in the forward direction, the process being reversed as more energetic radiation is scattered in the forward direction, a gradual decrease in the average energy of all radiation leaving absorbers of low atomic number, and an increase in the average energy of all radiation leaving the higher atomic number absorbers. Values of equilibrium absorber thickness have been estimated.

5492

POSITRON-ELECTRON SCATTERING IN HELIUM. G. Robert Hoke. Phys. Rev. 87, 285-9(1952) July 15.

Positron-electron scattering in a cloud chamber filled with He at a pressure of 105 cm of Hg has been studied. The positron source was Na^{22}, and the primary positron energies ranged from about 20 to 600 kev. On 2420 m of track length 1129 scattering events have been found with a fractional energy exchange between positron and electron greater than 10%. The frequency of scattering is in good agreement with the theory of Bhabha, but not enough events are available to discriminate between the theory with the effect of exchange taken into account and the theory without exchange (i.e., "ordinary" scattering). (auth)

5493

NEUTRON-PROTON SCATTERING IN THE REGION 0-5 MEV. L. Hulthén and S. Skavlem. Phys. Rev. 87, 297-303 (1952) July 15.

The theoretical cross section for scattering of neutrons by protons has been calculated on the basis of a pure central Yukawa potential with the same range in ^1S and ^3S states, corresponding to meson mass 200 and 300, respectively. The results indicate that the best over-all fit with most recent scattering experiments would be obtained with a meson mass of roughly 350 m_e. Allowing different ranges in singlet and triplet states and making use of the deuteron binding energy, a "triplet mass" of 290 and a "singlet mass" of about 380 were found. A further result of this work is that, at least in the case of Yukawa potential, the "effective range" approximation is prone to give the total cross section much more accurately than the singlet and triplet cross sections separately. Accordingly, this approximation ought to be handled with care in other problems than n-p scattering. (auth)

5494

DEDUCTION OF VARIOUS VARIATIONAL PRINCIPLES IN THE THEORY OF COLLISIONS FROM A SINGLE PRINCIPLE. T. Kahan and G. Rideau. J. phys. radium 13, 326-32 (1952) June. (In French)

The variational methods developed by Hulthén, Schwinger, Kohn, and others to solve the differential equations of scattering problems are derived from a very general variational principle.

5495

INELASTIC SCATTERING OF PROTONS FROM LIGHT NUCLEI. Dean B. Cowie, N. P. Heydenburg, and G. C. Phillips. Phys. Rev. 87, 304-6(1952) July 15.

An investigation has been made of inelastic scattering of 7.4-Mev protons at 90° from the following thin-foil targets: Be, C^{12}, C^{13} (47% enriched), CaF_2, Ni, Al, and Na, and from the following gas targets: normal BF_3, enriched $B^{10}F_3$ (96%), N_2, O_2, CH_4, and Ne. The following energy levels in Mev were observed: Be^9 2.57; B^{10} 2.34; B^{11} 2.06; C^{12} 4.59; C^{13} 3.14; 4.03; N^{14} 2.35, 3.95; O^{16} none; F^{19} 1.53, 3.83; Ne 1.44, 4.36; Na^{23} 3.67; Al 1.02, 2.30, 2.89, 3.32, 4.48; Ni 1.44. (auth)

5496
APPLICATION OF THE MULTIPLE SCATTERING THEORY TO CLOUD-CHAMBER MEASUREMENTS. I. Stanislaw Olbert. Phys. Rev. 87, 319-27(1952) July 15.

Some questions concerning the application of the multiple-scattering theory to the analysis of cloud-chamber pictures are discussed from the theoretical point of view: (a) The Molière theory of multiple scattering is modified by the consideration of the finite nuclear dimensions. It is assumed that the probability of single scattering goes abruptly to zero for angles greater than $\varphi_s = \varphi_m a/r_n$, where a is the radius of the statistical Thomas-Fermi atom, r_n the radius of the nucleus, and φ_m is the screening angle as derived by Molière. The distribution function for plural and multiple scattering is then derived for finite values of φ_s. It is shown that the cutoff affects especially the tail behavior of the distribution function as it was to be expected. While Molière's function decreases as φ^{-3} for projected angles of scattering large compared to the rms angle, the modified function decreases approximately as $(1/\varphi)$ times a Gaussian function of $(\varphi - \varphi_s)$ for angles large compared to the rms angle and the cut-off angle. (b) The distribution function for the mean value of the square angle of scattering in n plates of a multiple-plate cloud chamber is derived and compared with the normal χ^2-distribution. (c) The effect of observational errors on the distribution function for multiple scattering is estimated quantitatively and discussed in some detail for the case where the mean-square angle of real scattering is large compared to the variance of the noise-level scattering. (auth)

5497
THE INELASTIC SCATTERING OF NEUTRONS. Walter Hauser and Herman Feshbach. Phys. Rev. 87, 366-73(1952) July 15.

The total cross section and the differential cross section for the inelastic scattering of neutrons are considered. It is assumed that the compound nucleus is sufficiently excited so that the statistical model may be applied. If the statistical model may be applied as well to the residual nucleus, it is shown that the angular distribution of the inelastically scattered neutrons is isotropic. If only a few levels of the target nucleus can be excited, the angular distribution is anisotropic. Tables are provided which permit the calculation of the angular distribution if the incident and emergent neutron angular momenta are less than or equal to 3ħ. Examples of the evaluation of total cross sections are given, providing examples of the sensitivity of the results to the quantum numbers of the excited state. (auth)

5498
ON THE SCATTERING OF FAST ELECTRONS BY NUCLEI. L. R. B. Elton. Proc. Phys. Soc. (London) A65, 481-4(1952) July 1.

It is shown that, contrary to expectations from the non-relativistic case, the phase-shift ξ_n between the partial waves of electrons scattered by a point nucleus and by an extended nucleus respectively is positive for sufficiently large n, and that this is a spin effect and not merely a relativistic one. An approximate formula for ξ_n is evolved, and its usefulness is discussed. (auth)

5499
SLOW NEUTRON CRYSTAL SPECTROMETRY: THE TOTAL CROSS SECTIONS OF Co, Er, Hf, Ni^{58}, Ni^{60}, Ho, AND FISSION Sm. S. Bernstein, L. B. Borst, C. P. Stanford, T. E. Stephenson, and J. B. Dial. Phys. Rev. 87, 487-93(1952) Aug. 1.

A focusing spectrometer using a variable-curvature quartz crystal has been developed for measuring total cross sections vs. energy of small samples of rare elements, separated isotopes, and radioactive isotopes in the energy region 0.03 to ~1.5 ev. Samples having macroscopic cross sections from 0.1 to 1.0 mm^2 have been used as absorbers. The main features of the new instrument are described, and performance curves are given. The instrument was first used to show that a sample of rare-earth fission-product material has a resonance at an energy corresponding to the known resonance of Sm^{149}. Test runs were made on normal Co, whose total cross section was found to fit the formula, $\sigma(\text{barns}) = 5.0 + 6.1\ (E \text{ in ev})^{-1/2}$. A resonance at about 1 ev, attributed in the literature to Zr, was found to belong to Hf. Er was found to have a neutron resonance at about 0.5 ev. Ni^{58} was found to be the isotope primarily responsible for the anomalously high scattering cross section of normal Ni, confirming results from neutron-diffraction studies made simultaneously by other observers. Results are given also for Ni^{60}. Analysis of the Ho measurements give a scattering cross section that is strongly energy dependent. Paramagnetic scattering is suggested as a possible explanation of the variation. (auth)

5500
THE STOPPING CROSS SECTION OF D_2O ICE. W. A. Wenzel and Ward Whaling. Phys. Rev. 87, 499-503(1952) Aug. 1.

The energy loss of protons and deuterons in D_2O ice has been measured over the energy range E_p = 18 to 541 kev using the double-focusing magnetic spectrometer to measure the energy of the particles after they had traversed a known thickness of the ice target. One method of measurement is used to determine relative values of the stopping cross section as a function of energy; another method measures the absolute values. The results are in very good agreement with the values calculated from Bethe's semi-empirical formula. Possible sources of error are considered and the accuracy of these measurements is estimated to be ±4%. (auth)

5501
THE COHERENT NEUTRON SCATTERING CROSS SECTIONS OF NITROGEN AND VANADIUM. S. W. Peterson and Henri A Levy. Phys. Rev. 87, 462-3(1952) Aug. 1.

Neutron-diffraction measurements on V nitride, V carbide, and K azide show the coherent neutron-scattering cross section of N to be 11.1 ± 3 barns, positive phase, and that of V to be 0.029 ± 0.01 barn, negative phase. (auth)

5502
MULTIPLE SCATTERING OF ELECTRONS IN THIN FOILS. S. Leisegang. Z. Physik 132, 183-94(1952). (In German)

The angular distribution of multiply scattered electrons as a function of atomic number and thickness of the scattering foil has been calculated. Measurements of the scattering of 20- to 68-kev electrons in celluloid, Al, Ag, and Au vapor-deposited films of 100- to 1000-A thickness showed that the theory represents the facts very well.

RADIATION EFFECTS

5503
Brookhaven National Lab.
THE DENSITY EFFECT FOR THE IONIZATION LOSS IN VARIOUS MATERIALS, by R. M. Sternheimer. [nd] 37p. (BNL-1210)

The density effect for the ionization loss of charged particles has been calculated for a number of metals, scintillating materials, gases at various pressures, and photographic emulsion, using a dispersion model involving an appropriate number of dispersion oscillators for each substance. The results are presented in the form of graphs that can be used to correct the ionization loss for the density effect. The theoretical curves for AgCl and anthracene are in reasonable agreement with experiments on the ionization loss of μ mesons. A general derivation of the equations for the density effect is given. (auth)

5504
Massachusetts Inst. of Tech.
X-RAY STUDY OF RADIATION DAMAGE, by B. E. Warren. June 30, 1952. 4p. (NYO-3731)

A report is presented on the development of x-ray-diffraction methods for measuring and evaluating the nature of radiation damage in materials. The application of these methods to typical metals, alloys, and inorganic compounds is discussed.

5505
FLUORESCENCE PRODUCED BY ALPHA PARTICLES IN SOLUTION. I. M. Ageno and R. Querzoli. Rend. ist. super. sanità 15, 28-31(1952). (In Italian)

Using a deposit of Po as α-particle source, the authors show by a photographic method that of the fluorescence produced in xylene-0.5% terphenyl by α irradiation the part that is finally transformed into visible light first travels for a distance of several millimeters in the liquid. This is shown not to be caused by diffusion of either Po particles or excited molecules of the liquid.

5506
FLUORESCENCE PRODUCED BY ALPHA PARTICLES IN SOLUTION. II. M. Ageno and R. Querzoli. Rend. ist. super sanità 15, 32-5(1952). (In Italian)

A simple photographic study of the transfer of energy from particle to solution in xylene and xylene-0.5% terphenyl fluorescing under the action of Po α rays shows that this transfer takes place through emission and reabsorption at a distance of an electromagnetic radiation having a wave length exceeding 3000 A.

RADIOACTIVITY

5507
Brookhaven National Lab.
AVERAGE CHARGE PRODUCED BY ELECTRON CAPTURE IN A^{37}, by John A. Miskel and Morris L. Perlman. [nd] 5p. (BNL-1191)

The average charge on the Cl^{37} ion produced by the electron-capture decay of A^{37} has been measured as $+3.85 \pm 0.2$. The measurement depended on a determination of the current produced by collection of the primary recoil ions at the negative electrode of a vacuum tube. The ratio of current to the known A^{37} disintegration rate is the average charge per disintegration.

5508
Carnegie Inst. of Tech.
NATURAL RADIOACTIVITY OF LANTHANUM 138, by George I. Mulholland and Truman P. Kohman. June 1, 1952. 7p. (NYO-3229)

Measurements have been made of the natural radioactivity of La, purified to constant specific activity by ion-exchange and radiochemical techniques, using Al absorbers in a large internal-sample low-background proportional counter. Ba K x rays were observed with intensity 1.0/sec/g of element, corresponding to a specific electron-capture activity of 1.2/sec/g and a partial half life of 7×10^{10} yr for La^{138}. A hard electron component was attributed to negative β particles of maximum energy 1.0 ± 0.2 Mev and specific activity 0.07/sec/g, corresponding to a partial half life of 1.2×10^{12} yr. The log ft of 21.3 seems consistent with a fourth-forbidden transition from a $g_{7/2} - d_{3/2}$ configuration with spin 5 and even parity. (auth)

5509
Atomic Energy Project, Univ. of Calif., Los Angeles
BETA AND GAMMA INDUCED ČERENKOV RADIATION IN WATER, by M. A. Greenfield, A. Norman, A. H. Dowdy, and P. M. Kratz. Issued July 25, 1952. 9p. (UCLA-211)

The paper reports the determination of the energy spectrum of radiation induced in water by γ-ray bombardment, and of a similar radiation from water bombarded with P^{32} β rays. The spectral energy distribution is that predicted by the theory of Cherenkov radiation. (auth)

5510
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF WEEKLY RESEARCH PROGRESS MEETING, by S. Shewchuck. May 15, 1952. 6p. (UCRL-1833)

Disintegration of He by 90-Mev Neutrons. P. Tannenwald. The details of this talk may be found in UCRL-1767 (NSA 6-4223) or in an abstract report UCRL-1701. Complex Structures of α Emitters Using Nuclear Emulsions. D. Dunlavey. The details of this talk may be found in a brief report, UCRL-1783 (NSA 6-4248). Two representative photographs of electron tracks are presented which are not shown in UCRL-1783.

5511
BETA-SPECTRA AND INTERNAL CONVERSION COEFFICIENTS FOR Co^{60}, Nb^{95}, Au^{198}, and Hf^{181}. Chang-Yun Fan. Phys. Rev. 87, 252-62(1952) July 15.

Using a double-lens β-ray spectrometer, the β spectra and the internal-conversion coefficients for Co^{60}, Nb^{95}, Au^{198}, and Hf^{181} were investigated. All the β spectra were found to be of allowed shape with end-point energies 0.306 ± 0.005, 0.160 ± 0.003, 0.97 ± 0.01, and 0.408 ± 0.008 Mev, respectively. The extra activity presented in Au^{198} was identified to be Au^{199}, and the slow-neutron absorption cross section of Au^{198} was estimated to be about 10^5 barns. The internal-conversion coefficients indicate that both of the γ rays from Co^{60} are $E-2^2$ radiations; the 0.77-Mev γ ray from Nb^{95} is either an $M-2^1$ or an $E-2^2$ radiation or a mixture of both; the 0.411-Mev γ ray from Au^{198} is an $E-2^2$ radiation; the 0.474-Mev γ ray from Hf^{181} is an $E-2^2$ radiation, the 0.134- and 0.340-Mev γ rays are $M-2^1$ radiations, and the 0.130-Mev γ ray is doubtful but seems to be an $E-2^2$ radiation. The results are discussed from the point of view of the β-decay theory and the shell-structure model. (auth)

5512
FUNDAMENTALS OF RADIOACTIVITY. Pt. I of THE RADIOISOTOPE. AEC Isotopes Div. Bernard G. Saunders, tech. adviser. 1952. 16 mm film (PMF 5145a). B & W, sound, running time: 79 min. (cf. NSA 6-2840)

The film opens with a sequence tracing U from the prospector to the AEC. It next shows how U changes into other elements through the natural processes of radioactive decay and nuclear fission. Einstein's equation $E = mc^2$ is cited. Mention is made of the atomic bomb and the use of nuclear power for industry. Stable and radioactive isotopes are explained. Isotope charts and energy-level diagrams are employed to illustrate the decay of radioisotopes. The various radiations resulting from nuclear changes are described in detail. The nuclear reactor is described in terms of fission and moderation. Several scenes show raw materials introduced into a typical nuclear reactor and withdrawn as radioisotopes. The processing of fission products is also shown. Over 50 terms and concepts are defined and explained throughout the film so that succeeding films in the series may be clearly understood.

5513
INVESTIGATIONS ON THE ODD-ODD ISOTOPES Ga^{64}, Ga^{66}, Ga^{68}, AND THE ODD-EVEN ISOTOPE Ga^{67}. Ambuj Mukerji and Peter Preiswerk. Helv. Phys. Acta 25, 387-416(1952) June 30. (In English)

Disintegrations of the odd-odd isotopes Ga^{64}, Ga^{66}, and Ga^{68} have been investigated by spectrometer and coincidence measurements. The positron activity assigned in literature to Ga^{64} has to be attributed to some impurities. Disintegration schemes for Ga^{66} and Ga^{68} have been established. Spin assignments to ground states of Ga^{66} and Ga^{68} have been compared to those predicted by Nordheim's rules regarding odd-odd nuclei. Some new γ radiations observed during the course of disintegration of Ga^{67} are reported in a supplement, and a disintegration scheme is proposed. The findings are difficult to reconcile with the predictions from the shell model in its simplest form. (auth)

5514
THE DECAY OF ^{188}Re. R. Richmond, P. J. Grant, and H. Rose. Proc. Phys. Soc. (London) A65, 484-90(1952) July 1.

The γ rays emitted in the decay of Re^{188} have been investigated by means of absorption and coincidence techniques and by the use of a thin-lens β spectrometer. The γ-ray intensities (expressed as a percentage of the total number of β disintegrations) have been measured, and a probable decay scheme is proposed. (auth)

5515
AN INVESTIGATION OF THE DECAY SCHEME OF ^{153}Sm. R. C. Bannerman. Proc. Phys. Soc. (London) A65, 565-6 (1952) July 1.

The integrated-spectrum technique, i.e., thin source clamped between two halves of a NaI(Tl) crystal, has been used to measure the total disintegration energy of Sm^{153} as 800 ± 20 kev. The β and γ spectra were also determined separately, and γ-γ and β-γ coincidences were investigated. A decay scheme is proposed whereby Sm^{153} emits β particles of maximum energy 800(15%), 700(35%), and 630(50%) kev, leading respectively to the ground, 101-kev, and 170-kev states of Eu^{153}.

5516
THE 7 MEV LEVEL OF ^{12}C. G. Harries and W. T. Davies. Proc. Phys. Soc. (London) A65, 564-5(1952) July 1.

Evidence has been obtained for the decay by pair emission of an excited state of C^{12} at ~7 Mev. The source consisted of Po deposited on Pt foil and covered by a sheet of Be, and momentum measurements were made by means of a cloud chamber in a magnetic field of 550 gauss. Of 79 measured pairs 72 had a total energy of 4.4 ± 0.5 Mev, while seven had a total energy of 7.0 ± 0.6 Mev. The probability of pair emission from the 7-Mev state is small compared to that of radiative transition to the 4.45-Mev state; so a γ ray of energy ~2.5 Mev and intensity ~⅙ that of the 4.45-Mev line is expected.

5517
THE DISINTEGRATION OF Ce^{144} AND Pr^{144}. Fred T. Porter and C. Sharp Cook. Phys. Rev. 87, 464-8(1952) Aug. 1.

The radiations from the radioactive chain $Ce^{144} \rightarrow Pr^{144} \rightarrow Nd^{144}$ have been investigated, using chemically purified sources. Ce^{144} (295-day half life) decays to the ground state of Pr^{144} through a 70% abundant β group having a maximum energy of 304 ± 2 kev. Conversion electrons have been observed which indicate that within the Pr nucleus there are transitions having energies 33.7, 53.5, 80.7, 100.3, and 134.2 kev. The predominant number of the Pr^{144} β transitions go directly to the ground state of Nd^{144} through a 2.97 ± 0.01-Mev β group. Conversion electrons from a weak 60.3-kev transition in Nd have been observed. Very weak γ radiations having energies 0.696, 1.5, and 2.185 Mev have been observed. The β spectrum indicates that less than 2% of the β transitions go to excited states of Nd at 0.696 and 2.185 Mev. Using the evidence available a disintegration scheme is proposed. (auth)

5518
THE DISINTEGRATION OF Cs^{130}. Alan B. Smith, Allan C. G. Mitchell, and Robert S. Caird. Phys. Rev. 87, 454-6 (1952) Aug. 1.

The disintegration of Cs^{130} (30-min) has been studied with the help of a magnetic-lens spectrometer and a NaI(Tl) scintillation spectrometer. Cs^{130} decays to both Xe^{130} by positron emission and K-electron capture and to Ba^{130} by negatron emission. The end-point energy of the positrons is 1.97 Mev and of the negatrons 0.442 Mev. Since no γ rays other than annihilation radiation were observed, it is assumed that the disintegration leads to the ground state of both Xe^{130} and Ba^{130}. (auth)

5519
β^- DISINTEGRATION OF Br^{80}. Jeanne Laberrigue-Frolow. Compt. rend. 234, 2599-601(1952) June 30. (In French)

In order to eliminate that portion of the spectral deformation caused by the 180° spectrograph previously used, the β^- spectrum of Br^{80} was restudied with a thick-magnetic-lens spectrograph. E_{max} was found to be 1.99 ± 0.01 Mev. Although the Fermi decomposition of the spectra indicates a component with an E_{max} of 1.1 Mev and 15% of the total intensity, no γ rays or conversion electrons corresponding to this energy could be found, indicating a forbidden transition in Kr^{80}. The deformed spectrum suggests a mixture of interactions.

5520
STUDY OF THE 350-KEV γ TRANSITION ACCOMPANYING THE α EMISSION IN AcC → AcC″. P. Falk-Vairant, J. Teillac, and C. Victor. J. phys. radium 13, 313-16(1952) June. (In French)

The α−conversion electron coincidences in AcC (Bi^{211}) were studied with a proportional counter and a thin-window Geiger counter. The value obtained of 3.0 ± 0.3 conversion electrons/100 disintegrations, recent data on the α fine structure, and a new measurement of the K to L conversion-electron ratio has permitted calculation of the coefficient of conversion relative to the K shell: $\alpha_K = 0.18 \pm 0.03$. The transition is probably a mixture of magnetic dipole and electric quadrupole radiation. Possible values of spin for the excited and ground states of AcC″ (Tl^{207}) are discussed.

5521
CONFIGURATION FORBIDDENNESS IN β RADIOACTIVITY. M. Trocheris. J. phys. radium 13, 370-1(1952) June. (In French)

Certain β disintegrations of odd-A nuclei seem to be forbidden for other reasons than spin and parity selection rules. A type of selection rule involving proton and neutron configuration is developed and shown to explain the degree of forbiddenness in the β decay of Y^{87}, Zr^{89}, Cd^{115}, and C^{14}.

5522
THE SARGENT DIAGRAM FOR THE ELECTRON-CAPTURE PROCESS, AND THE DISINTEGRATION ENERGIES OF HEAVY β-EMITTERS. N. Feather. Proc. Roy. Soc. Edinburgh A63, 242-56(1950-1).

A sargent diagram is presented containing 12 plotted points relative to capture-active species in the range of atomic number (Z) from 89 to 98 inclusive. Arguments are adduced to show that the "allowed" line of the diagram is located as theory predicts, and the capture transformations of other heavy capture-active species are discussed with the aid of the diagram. In particular, values are deduced for the energies of capture transformation of 17 species for which $79 \leq Z \leq 85$, and, taking count of these values, the energies of β disintegration of 150 species having $76 \leq Z \leq 98$ are as-

sumed known, and are suitably plotted against neutron number N. Discontinuities are found, for certain values of isotopic number, in the region N = 126 (and Z = 82). Values of α-disintegration energy also are deduced for certain isotopes of Bi and Pb. (auth)

THEORETICAL PHYSICS

5523

HIGHER-ORDER MESON-THEORY CORRECTIONS TO THE MAGNETIC MOMENT OF THE PROTON. A. Thellung. Helv. Phys. Acta 25, 307-38(1952) June 30. (In German)

The fourth-order corrections to the magnetic moment of the proton, due to the coupling with a neutral pseudoscalar meson field, are calculated within the framework of Dyson's radiation theory, a slightly different method of self-energy subtraction being used. The integrations over the Feynman parameters are carried out only in the approximation $\delta^2 = (\mu/M)^2 = 0$. The results are unable to compensate the wrong second-order contributions. Some questions concerning the renormalization of the coupling constant are discussed in detail, and it is shown that, to a certain extent, the definition of what has to be interpreted as renormalization terms is arbitrary, without modifying the quantitative predictions of a theory. (auth)

5524

ON THE DEFINITION OF THE RENORMALIZATION CONSTANTS IN QUANTUM ELECTRODYNAMICS. Gunnar Källén. Helv. Phys. Acta 25, 417-34(1952) June 30. (In English)

A formulation of quantum electrodynamics in terms of the renormalized Heisenberg operators and the experimental mass and charge of the electron is given. The renormalization constants are implicitly defined and expressed as integrals over finite functions in momentum space. No discussion of the convergence of these integrals or of the existence of rigorous solutions is given. (auth)

5525

THE CLASSICAL EQUATIONS OF MOTION OF POINT PARTICLES. I. Peter Havas. Phys. Rev. 87, 309-18(1952) July 15.

The problem of the relation of field theory and action at a distance is investigated for the neutral vector and scalar meson theories. The equations of motion of point particles with half-advanced, half-retarded interaction are found using the field theoretical methods developed for retarded interaction; they include an integral over the entire motion of the particle in analogy to an integral over the past motion in the retarded case. These are inadmissible from the point of view of action at a distance, and a new set of equations is postulated. This new set is derivable from a variational principle analogous to Fokker's in electrodynamics for the symmetric case, and energy-momentum tensors guaranteeing the conservation laws can be defined. The application of the Wheeler-Feynman method to the equations of the symmetric case leads to the equations of the retarded case only for the field theoretical equations, but to slightly different ones for those of action at a distance. Some implications of these results are discussed. (auth)

5526

MASS CORRECTIONS TO THE FINE STRUCTURE OF HYDROGEN-LIKE ATOMS. E. E. Salpeter. Phys. Rev. 87, 328-43(1952) July 15.

A relativistic four-dimensional wave equation, derived previously, for bound states of a two-body system is discussed further. For any "instantaneous" interaction function an exact three-dimensional equation is derived from it, similar to, but not identical with, the Breit equation. A perturbation theory is developed for a small additional non-instantaneous interaction. Using this covariant method, corrections of relative order $\alpha(m/M)$ to the fine structure of H, due to the finite mass of the nucleus, are calculated. No terms of this order were obtained in previous approximate treatments using the Breit equation. Some of the terms obtained contain log α as a factor. It is shown that these special terms can also be derived simply by means of orthodox quantum electrodynamics and perturbation theory. These corrections to the fine structure are +0.379 Mc for the 2s state of H and −0.017 Mc for the 2p state. For H-like atoms with heavier nuclei the corrections are roughly (Z^5/A) times those for H. (auth)

5527

PHYSICAL INTERPRETATION OF WAVE MECHANICS AND THE HYPOTHESIS OF HIDDEN PARAMETERS. Jean-Louis Destouches. J. phys. radium 13, 354-8(1952) June. (In French)

For a microscopic system S and a measuring apparatus a_A, it is necessary to distinguish between the system (microscopic $S + a_A$, formed by the assembly of S and a_A, and the couple S/a_A formed by the system S under observation by the apparatus a_A. It is established that an objective description, making use of imaginary "hidden" variables, of a_A exists that conforms to the requirements of a point mechanics and makes the same predictions as wave mechanics concerning the magnitude A in the system S. On the contrary, no such objective description exists for S or for $S + a_A$. A description apparently may be given for another magnitude B (not measurable simultaneously with A) in the same phase space as A.

5528

THERMODYNAMIC VACUUM OSCILLATIONS OF WAVE FIELDS. Adrian E. Scheidegger and Carlyle D. McKay. Z. Physik 132, 179-82(1952). (In German)

In connection with earlier work on the quantum statistics of wave fields (Phys. Rev. 83, 125(1951); NSA 5-4637), the expression for the thermodynamic vacuum oscillations of the latter are derived. It is shown that the creation of elementary particles by the thermal oscillation of the corresponding field is extremely improbable.

TRACER APPLICATIONS

5529

THE USE OF RADIOACTIVE ISOTOPES IN A STUDY OF EVAPORATION FROM THERMIONIC CATHODES. W. F. Leverton and W. G. Shepherd. J. Applied Phys. 23, 787-93 (1952) July.

Radioactive tracers have been used in a study of evaporation of the alkaline earths, Ba, Sr, and Ca, from oxide coatings on passive Ni bases. Several percent of the total cathode Ba, Sr, and Ca leave a triple oxide cathode during processing and aging. The rates of transfer of these elements from the cathode during life tests of 118 hours at true cathode temperatures from 1175 to 1279°K obey equations of the form, $\log W = A - (B/T)$, where W is the rate of transfer in $g/cm^2/sec$, T is the absolute temperature of the cathode, A and B are constants. The transfer of Ba from a BaO cathode obeys a similar law. The mass of Ba transferred in 118 hours of life from a triple oxide cathode at 1123°K true as 2.9×10^{-6} g/cm^2, and from a BaO cathode 1.4×10^{-5} g/cm^2. The masses of Sr and Ca transferred from a triple oxide cathode at the same temperature were 2.1×10^{-7} and 1.2×10^{-8} g/cm^2, respectively. Bombardment of the anode by an electron beam during life tests decreased the quantity of Sr observed on the anode. Anode current densities of 5 to 10 ma/cm^2 at electron energies of approximately 100 volts produced a fiftyfold reduction in the quantity of Sr on the anode. Experiments indicated that this decrease was not due to heating of the anode. The quantity of Ba deposited on the anode was not decreased by electron bombardment. The very considerable transfer of Ba from the cathode during processing was greatly reduced by breaking down the carbonates and high temperature flashing the cathodes in the presence of a few mm pressure of argon gas. (auth)

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA. In general, this list refers only to those reports abstracted in issues preceding the current one. Orders for items for which prices are indicated should be directed to:

Office of Technical Services
Department of Commerce
Washington 25, D. C.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS
ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948
AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)
AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
AECD-1945(Rev.)	NSA 6-4866	$0.06
3234	5-5588	Rev. Sci. Instruments 23, 332-4 (1952)
3248	5-6281	Rev. Sci. Instruments 23, 357-61 (1952)
3267	5-7251	Phys. Rev. 87, 444-7(1952)
3395	6-4249	$0.45
AECU-1655	5-6803	Rev. Sci. Instruments 23, 379(1952)
1838	6-1491	J. Chem. Phys. 20, 752-3
1864	6-1651	J. Am. Chem. Soc. 74, 3773-6(1952)
1906	6-2324	Phys. Rev. 87, 439(1952)
1924	6-2310	Anal. Chem. 24, 770-3(1952)
2100	6-4684	NSA
2115	6-4924	NSA
AMRL-66	6-31	Endocrinology 50, 550-4(1952)
BNL-1154	6-3434	Phys. Rev. 87, 448-51(1952)
ISC-176	5-6820	J. Phys. Chem. 56, 799-800(1952)
211	6-2301	Proc. Natl. Acad. Sci. 38, 400-8 (1952)
UCRL-1784	6-4193	Phys. Rev. 87, 393-4(1952)
1815	6-4582	$0.60
1819	6-4897	Phys. Rev. 87, 383-4(1952)
1828	6-4595	$0.45
1846	6-4760	NSA
UR-142(p.13-15)	NSA 5-2380	Arch. Biochem. Biophys. 36, 399-410(1952)
UR-181	5-5559	J. Am. Chem. Soc. 74, 2337-40 (1952)
184	5-6624	J. Biol. Chem. 195, 843-8(1952)
208	6-4722	J. Biol. Chem. 196, 463-8(1952)
210	6-4701	J. Exptl. Med. 95, 531-42(1952)
Y-642(Rev.)	6-4489	$0.35
K-834	5-6864	Rev. Sci. Instruments 23, 321-7 (1952)
NP-1863(T.R.1)	5-2493	Phys. Rev. 78, 483-4(1950)
1863(T.R.2)	5-2494	Rev. Sci. Instruments 22, 259-63 (1951)
3619	6-1853	Nucleonics 3, No. 2, 5-16(1948)
3946	6-4944	Phys. Rev. 87, 141-5(1952)
NYO-602	6-2918	$0.35
3207	6-3016	Phys. Rev. 87, 344-51(1952)
3396	6-2685	Phys. Rev. 87, 504-16(1952)
ORNL-812	5-510	J. Bact. 63, 707-13(1952)
TID-5059(1st Rev.)	6-3481	$0.55
UCRL-1410(Rev.)	6-3090	Phys. Rev. 87, 434-8(1952)
1586	6-1862	Phys. Rev. 87, 358-65(1952)
1681	6-2775	Phys. Rev. 87, 277-85(1952)
1756	6-4592	$0.45

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 6B, page "SUPPLEMENT 1".

H	σ_t(14.1 Mev) 0.689	H. L. Poss et al., Phys. Rev. 87, 11 (1952); 85, 703A (1952).
$_1H_1^2$	σ_t(14.1 Mev) 0.80	H. L. Poss et al., Phys. Rev. 87, 11 (1952).
$_4Be_3^7$	Maximum energy of Li^7 recoils = 56 ev EA	R. Davis, Jr., Phys. Rev. 86, 976(1952).
$_5B_6^{11}$	d,p(θ) Be^9(d,p) E_d = 1.0 – 2.2	F. L. Canavan, Phys. Rev. 87, 136(1952).
C	σ_t(14.1 Mev) 1.279	H. L. Poss et al., Phys. Rev. 87, 11 (1952); 85, 703A (1952).
N	σ_t(14.1 Mev) 1.7	H. L. Poss et al., Phys. Rev. 87, 11 (1952).
$_7N_7^{14}$	O^{16}(d,α) Only g.s. α's found for N^{14} excitation up to 2.8 Mev.	R. J. Van de Graaff et al., Phys. Rev. 86, 966(1952).
O	σ_t(14.1 Mev) 1.64	H. L. Poss et al., Phys. Rev. 87, 11 (1952).
$_{12}Mg_{13}^{25}$	Levels Al^{27}(d,α) / Mg^{24}(d,p) 0.583 0.976 2.562 3.405 1.611 2.736 3.898 1.957 2.799 3.969 E_d = 1.5 – 2.1 ppl	P. M. Endt et al., Phys. Rev. 87, 27 (1952); 86, 630A (1952).
$_{13}Al_{14}^{27}$	Levels Si^{29}(d,α) sπ 0.84 1.01 2.21 ? 2.74 ?	D. M. Van Patter, W. W. Buechner, Phys. Rev. 87, 51 (1952).
$_{14}Si_{15}^{29}$	Levels Si^{28}(d,p) sπ 1.278 4.840 2.027 4.897 2.426 4.934 3.070 5.946 3.623 6.105 4.078 6.380	D. M. Van Patter, W. W. Buechner, Phys. Rev. 87, 51 (1952).
$_{14}Si_{16}^{30}$	Levels Si^{29}(d,p) sπ 2.24 3.51 3.79	D. M. Van Patter, W. W. Buechner, Phys. Rev. 87, 51 (1952).
$_{14}Si_{17}^{31}$	Levels Si^{30}(d,p) sπ 0.757 3.140 1.699 3.539 2.319 4.384 2.791	D. M. Van Patter, W. W. Buechner, Phys. Rev. 87, 51 (1952).
$_{26}Fe_{33}^{59}$	α 1.11 sl;ce$^-$ $\alpha_K = 1.45 \times 10^{-4}$ 1.30 $\alpha_K = 0.84 \times 10^{-4}$ $(0.26\beta^-)/(0.46\beta^-)$ = 48/52	D. Brower et al., Phys. Rev. 86, 1054(1952).
$_{27}Co_{29}^{58}$	γ 0.87 2.04 scin 1.25 2.53 1.73 d 6.4^d Ni^{58}	R. K. Sheline, R. W. Stoughton, Phys. Rev. 87, 1(1952).
$_{28}Ni_{28}^{58}$	τ 6.4 ± 0.1^d β^+ <1%, α<0.02% γ 100%* 0.17 scin 30% 0.28 40% 0.48 80% 0.81 10% 0.96 5% 1.33 15% 1.58 2% 1.75 (Co K X-ray)γ, $\gamma\gamma$ p 80^d Co^{58}	R. K. Sheline, R. W. Stoughton, Phys. Rev. 87, 1(1952). Fe^{54}(39 Mev α,2n); ion chem. *Relative intensities.
	τ 6.0 ± 0.5^d K γ 0.16 scin ~0.25 ? 0.5 0.8 >1.4 p 80^d Co^{58}	W. J. Worthington, Jr., Phys. Rev. 87, 158(1952). Zn(340 Mev p); ion chem. Fe(α,2n).
$_{28}Ni_{29}^{57}$	γ 0.114 scin 1.39 1.90	R. K. Sheline, R. W. Stoughton, Phys. Rev. 87, 1(1952). Fe^{54}(39 Mev α, n); ion chem.
$_{29}Cu_{35}^{64}$	γ 1.34 sl;ce$^-$ α_K~1.3 × 10^{-4}	D. Brower et al., Phys. Rev. 86, 1054 (1952).

$^{37}Rb^{82?}_{45}$ short	τ	short		S. V. Castner, UCRL-942(1950). All radiations observed in decay of 25.5^d Sr.
	β^+	3.15	sz√2	
	γ	~0.15	s,a	
		~0.40	s	
		0.95	a	
$^{37}Rb^{83}_{46}$	γ	~0.15	s	S. V. Castner, UCRL-942(1950). d 38^h Sr.
		~0.45	s	
		0.8	a	
	p 1.9^h Kr			
$^{37}Rb^{86}_{49}$	β^-	1.785	s	J. Moreau, J. Perez y Jorba, Compt. rend. 235, 38(1952).
	$\Delta I = 2$, yes shape			
$^{38}Sr^{81}_{43}$	τ	29^m		S. V. Castner, UCRL-942(1950). Rb(60 Mev p); chem.
	p 4.7^h Rb; 13^s Kr			
$^{38}Sr^{82?}_{44}$	τ	25.5^d		S. V. Castner, UCRL-942(1950). Rb(40 Mev p); chem.
	Not p 6.3^h Rb			
	For possible γ's see $Rb^{82?}$			
$^{38}Sr^{83}_{45}$	τ	38^h		S. V. Castner, UCRL-942(1950). Rb(25 Mev p); chem.
	β^+	1.15	sz√2	
	γ's	0.040 0.151	ce$^-$	
		0.074 0.165		
		0.101		
	p 107^d Rb, 1.9^h Kr			
$^{38}Sr^{85}_{47}$ 70^m	K	14%		A. W. Sunyar et al., Phys. Rev. 86, 1023(1952); 85, 734A(1952). Sr^{84}(pile n).
	γ	84.7% 0.0075		
		α = large	E3	
		0.150		
		84.7% 0.225	M1	
		α_K ~0.026		
		K/L~5		
		1.3% 0.233	M4	
	(0.150γ)X		(Rb)	
	No (0.233γ)X			
			sl;ce$^-$,scin	
	65^d	K		A. W. Sunyar et al., Phys. Rev. 86, 1023(1952); 85, 734A(1952). Rb(d); chem.
		γ 100% 0.513		
		α = 0.008	M2	
		$\tau = 0.9^{\mu s}$		
			sl;ce$^-$,scin	
$^{39}Y^{90}_{51}$	β^-	2.27	s	J. Moreau, J. Perez y Jorba, Compt. rend. 235, 38(1952).
	$\Delta I = 2$, yes shape			
$^{39}Y^{91}_{52}$ 57^d	β^-	1.56	s	J. Moreau, J. Perez y Jorba, Compt. rend. 235, 38(1952).
	$\Delta I = 2$, yes shape			
$^{41}Nb^{96}_{55}$	β^-	8% 0.37	sz	D. R. Jones et al., Phys. Rev. 86, 654A(1952). Zr^{96}(p,n).
		92% 0.69		
	γ	0.455	pe$^-$	
		0.545	pe$^-$	
		0.745	ce$^-$,pe$^-$	
		0.9	pe$^-$	
		1.045	ce$^-$,pe$^-$	
		1.1	ce$^-$	
$^{43}Tc^{87?}_{44}$	τ	42^m		R. A. House et al., Phys. Rev. 86, 654A(1952). Mo^{97}, Mo^{98}(6.3 Mev p).
	K	~50%		
	β^+	~50% 2.1	a	
	γ	0.2	ce$^-$,a	
		0.86	a	
	2.8^d not confirmed			
$^{43}Tc^{100}_{57}$	τ	15.8^s		G. E. Boyd et al., Phys. Rev. 86, 1051(1952). Tc^{99}(th n).
	β^-	2.8	a	
	γ			
	80^s due to F^{17}			
	τ	17.5^s		R. A. House et al., Phys. Rev. 86, 654A(1952). Mo^{100}(6.3 Mev p).
	β^-	2.4	a	
	γ's			
	80^s not found			
In	σ_t(1 – 30 ev) graphs			V. L. Sailor, L. B. Borst, Phys. Rev. 87, 161(1952). *Enriched materials used.
	E_0(ev)	Isotope*		
	1.458	115		
	1.80	113		
	3.86	115		
	4.69	113		
	9.16	115		
	12.1	115		
	14.8	113		
	22 – 26	113		
	23.5	115		
$^{52}Te^{133}_{81}$ 63^m	γ	0.3 – 0.4	scin,a	A. C. Pappas, Phys. Rev. 87, 162(1952).
		α = large		
	~2^m	τ_2	~2^m	A. C. Pappas, Phys. Rev. 87, 162(1952).
		β^- ~70%	1.3 a	
		~30%	2.4	
		γ	0.6 a	
			1.0	
	d 63^m Te^{133}			
$^{58}Ce^{144}_{86}$	β^-	0.31	sz	F. T. Porter, C. S. Cook, Phys. Rev. 85, 733A(1952).
	w	0.45		
$^{59}Pr^{142}_{83}$	β^-	2.14	s	J. Moreau, J. Perez y Jorba, Compt. rend. 235, 38(1952).
	$\Delta I = 2$, yes shape			
	γ	1.58	sl;pe$^-$	E. N. Jensen et al., Phys. Rev. 86, 1047(1952).
	No other γ			
$^{62}Sm^{147}_{85}$	No e$^-$		ppl	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$^{78}Pt^{195*}_{117}$	τ_1	4.4^d		B. C. Haldar, Phys. Rev. 87, 158(1952). Pt(n,γ); chem. *Author assigns to Pt^{193}.
	e$^-$	0.12	a	
$^{78}Pt^{197}_{119}$ 18^h	τ_2	19^h		B. C. Haldar, Phys. Rev. 87, 158(1952). Pt(n,γ); chem.
	β^-	0.62	a	
$^{82}Pb^{210}_{128}$	β^-	0.017	pc	A. A. Jaffe, S. G. Cohen, Phys. Rev. 86, 1041(1952).
	≥10%	0.0556		
$^{90}Th^{232}_{142}$	γ	0.055	ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
	e^-/α = 24%			
$^{92}U^{232}_{140}$	γ	0.060	ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
	e^-/α = 30%			

$_{92}U^{236}_{144}$	γ 0.050 $e^-/\alpha = 27\%$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165(1952).
$_{92}U^{238}_{146}$	γ 0.045 $e^-/\alpha = 22$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{93}Np^{237}_{144}$	γ's ≤0.065 $e^-/\alpha = 80\%$ $e^-e^-\alpha$, $e^-e^-e^-\alpha$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{94}Pu^{236}_{142}$	γ 0.045 $e^-/\alpha = 20\%$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{94}Pu^{238}_{144}$	γ 0.040 $e^-/\alpha = 23\%$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{94}Pu^{239}_{145}$	γ 0.035 0.050 $e^-/\alpha = 12\%$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{95}Am^{241}_{146}$	α 1.4% 5.379 14% 5.433 84% 5.476 0.21% 5.503 0.34% 5.535 0.23% 5.546		s	F. Asaro et al., Phys. Rev. 87, 277 (1952); 85, 758A (1952).
	γ's ≤0.065 $e^-/\alpha = 56\%$ $e^-e^-\alpha$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).
$_{96}Cm^{242}_{146}$	α 27% 6.064 73% 6.110		s	F. Asaro et al., Phys. Rev. 87, 277 (1952); 85, 758A (1952).
	γ 0.045 $e^-/\alpha = 23\%$		ppl;ce$^-$	D. C. Dunlavey, G. T. Seaborg, Phys. Rev. 87, 165 (1952).

Q's Between Ground States

$Si^{28}(d,p)Si^{29}$	+6.246 ± 0.010	D. M. Van Patter, W. W. Buechner, Phys. Rev. 87, 51(1952); 85, 142(1952).
$Si^{29}(d,\alpha)Al^{27}$	+5.994 ± 0.011	
$Si^{29}(d,p)Si^{30}$	+8.338 ± 0.013	
$Si^{30}(d,p)Si^{31}$	+4.364 ± 0.007	